Enhancing Agriculture in Africa: A U.S. Role in Development Assistance

Volume II--Contract Papers

Part B: The USDA Data Base and the Potential of Low-Resource Agriculture

1. The Potential of Low-Resource Agriculture in African Development
   (John M. Staatz)
2. OTA Technical Paper Series: Potentials for Development in Low-Resource Technologies for African Agriculture
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11. *The Role of Low-Resource Agriculture in Africa: Zimbabwe Supplementary)*
    (Brian D'Silva and Arthur Dommen)

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Contract Paper No. 1

DRAFT

LOW-RESOURCE AGRICULTURE IN AFRICA

The Potential of Low-Resource Agriculture in African Development

by

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DRAFT

LIST OF ACRONYMS

CIMMYT--International Maize and Wheat Improvement Center (Spanish acronym)

ICRISAT--International Crop Research Institute for the Semi-Arid Tropics

IRRI--International Rice Research Institute

WARDA--West African Rice Development Authority

I. ABSTRACT

1. There is a strong case for basing the economic development of Africa on the progressive modernization of smallholder agriculture. Such a strategy will involve greater use by farmers of both internally and externally supplied agricultural inputs. Both theory and current knowledge of the structure of African agriculture suggest the broad guidelines for such a strategy, yet given the heterogeneity of African agriculture, much more investment in agricultural research is needed to develop the technologies on which it will be based.

2. Ignoring low-resource agriculture would imply ignoring the bulk of African farmers. Because most African farmers practice low-resource agriculture, LRA must be the starting point for a development strategy. Focusing instead on large-scale, capital-intensive farms will result in a highly unbalanced pattern of agricultural growth that will hinder industrial development and the growth of employment. Failure to raise the incomes of the mass of smallholders in Africa and generate employment for the rapidly growing labor force will result in slower economic growth, greater food insecurity, and higher levels of rural-urban migration.

3. Attempts to transfer either the U.S. or the Indian model of agricultural development directly to Africa are likely to fail. Compared to India, African agriculture is more heterogeneous, the African economies are smaller and more open, and there is a much weaker base of scientific knowledge regarding agriculture and many fewer trained personnel, these factors limit the effectiveness of foreign assistance.

4. There are strong reasons to support smallholder agriculture in Africa. Given Africa's rapidly growing population, however, it is imperative that new technologies be developed to increase labor productivity in smallholder agriculture. While soil and water conservation practices will likely be part of the package, greater reliance on externally supplied inputs will also be necessary. There is therefore a strong need for greater investment in research to develop appropriate productivity-increasing technologies for farmers and in strengthening the supporting institutions, particularly input, factor, and output markets, necessary to support a smallholder strategy.

II. POTENTIAL CONTRIBUTIONS AND LIMITATIONS OF LOW-RESOURCE AGRICULTURE FOR ACHIEVING FOOD SECURITY AND IMPROVING AFRICAN ECONOMIC DEVELOPMENT

5. This section draws upon the statistical profile of low-resource agriculture (LRA) prepared by USDA for OTA (D'Silva and Dommen, 1986) and the writings of several economists to examine the potential contributions and limitations of LRA for achieving food security and improving African economic development. In order to use the USDA data it is first necessary to examine how USDA defined LRA.

A. Operational Definition of Low-Resource Agriculture

6. An operational definition of LRA should (a) capture the essential elements of LRA from a policy perspective and (b) allow LRA be identified and, at least to some extent, quantified given existing data. OTA (1986) defines LRA as "agricultural systems used by poor, small-scale farmers and herders that rely principally on local inputs in order to support household activities," and goes on to list a number of other characteristics of LRA, all the while recognizing the wide diversity of LRA in Africa. Conceptually, this definition captures many of the essential elements of LRA.[1] It does not allow quantification, however, due to the imprecision of the term "principally" and because the extremely weak aggregate data on agricultural production in Africa generally do not distinguish farmers' degree of use of modern inputs, only whether or not they use them at all (D'Silva, personal communication).[2] Therefore, even if there were agreement on a quantitative definition of the term "principally," one could not quantify how many farmers rely "principally" (but not exclusively) on local inputs.

7. The USDA approach, which defines LRA as "any agricultural production process in which no modern inputs...or modern technology...is utilized"

(D'Silva and Dommen, 1986), does allow quantification given the existing data, but is conceptually less satisfying because many smallholders in Africa who use small quantities of modern inputs share the same problems of those who use none; hence, USDA's definition is too conservative. In addition, in developing its quantitative estimates of the extent of LRA in Africa, USDA was constrained by the data to look at production on a crop basis rather than on a farm basis. For example, the data indicate that 74% of the millet produced in semi-arid areas is produced under LRA conditions. This does not mean, however, that 74% of millet producers in these areas use no modern inputs, as some may grow cash crops, such as cotton, in rotation with millet, using substantial quantities of purchased inputs on the cash crops. The millet may benefit from the residual effects of these inputs.[3] This has implications for encouraging greater use of purchased inputs: such farmers may be aware of non-LRA techniques from their cash crops, and hence diffusion of non-LRA techniques to their food cropping activities may be easier than among farmers who have never used any modern inputs.[4]

8. If one is restricted to using aggregate production data (which are the only comparable data available across all African countries), then one is constrained to using a definition of LRA similar to USDA's if the aim is to get a quantitative estimate of the extent of LRA on the continent. Such a definition can be used as an operational definition with two caveats: (a) It provides a lower bound on the volume or area of various crops produced under LRA conditions. (b) It gives an estimate of crop production under LRA conditions, not the numbers of farmers involved in LRA. Identifying the percentage of various crops produced under LRA conditions may suggest broad areas for research, but outlining the details of what work needs to be done

requires an understanding of farmers' constraints from a farming systems perspective, which should include investigation of the interactions between the crops grown under LRA and non-LRA conditions.

9. In countries where reliable farm-level survey data exist, more subtle definitions of LRA are possible, focussing either on degree of modern input use (see footnote 2) or on the gross value of agricultural production per person. The latter definition is possible because a key characteristic of LRA in Africa is low labor productivity, which results in the poverty of low-resource agriculturalists. Returns to labor are a residual after nonlabor costs of production are deducted from gross returns; these returns to labor can be low because gross returns are low or because nonlabor input costs are high. In the case of LRA, nonlabor input costs are low, hence low labor productivity is reflected in low gross returns per person. Therefore one could define LRA as agriculture that generates a gross value of production per person below some given level.[5] Defining LRA in this manner stresses the need to increase labor productivity in LRA in order to increase the incomes of low-resource agriculturalists.

10. In practice, even with its conservative definition of LRA, the USDA analysis indicates that LRA is extremely widespread in Africa. From the point of view of U.S. foreign assistance policy it probably matters little whether LRA accounts for 74% or 83% of millet production in Africa; what is important is that the most producers are low-resource agriculturalists and they account for the bulk of production. The weakness of the statistical base on LRA in Africa is simply a manifestation of the underinvestment in agriculture, and in LRA in particular, that characterize Africa.

Potential Contributions and Constraints of LRA in Contributing to Food Security and Improving African Economic Development

1. Definition of Food Security

11. Food Security can be defined as the ability of a country to assure, on a long-term basis, that its food system provides the total population a timely, reliable, and nutritionally adequate supply of food (Eicher and Staatz, 1985). This definition has several implications that are important when considering the possible role of LRA in contributing to food security:

a. Food security should be defined in terms of the access of individuals or households to food, not simply in terms of per capita food availability. In other words, one has to think about LRA can contribute to broad-based access to food, not just to total food production.

b. Access to food requires that an adequate supply of food be available (either through domestic production or imports) and that the individual have some claim on it: ownership because s/he produced it, money to purchase it through the market, or some other socially recognized claim (Sen, 1981). Hence, improving food security involves not only increasing the supply of food but also increasing the poor's real income and hence their effective demand for food.* To the extent that LRA can increase the real incomes of the poor it can contribute to their food security even if a substantial proportion of their production is in nonfood crops. For this to occur, however, a well functioning food marketing system must be in place that allows low-resource agriculturalists to translate their increased cash incomes into food.

c. Food security also has a transitory versus chronic dimension (Reutlinger, 1985). Transitory food insecurity occurs when access to food becomes reduced because of *temporary* disruptions in (a) the supply of food (e.g., due to a decline in food production or disruption of the marketing system) or (b) people's ability to gain access to the existing supply (due, for example, to a temporary fall in real incomes and hence their effective demand for food, as might occur among cotton farmers if their cotton crop failed). *Transitory* food insecurity therefore refers to the *vulnerability* of people to short-term periods of inadequate food consumption. *Chronic* food insecurity refers to ongoing, long-term hunger due to chronically low supplies of food or chronically low income; therefore, it reflects much more the *low productivity* of the food system, low income-earning capacity of the poor, or both.

12. The dimensions of food insecurity and examples of measures to deal with them are shown in figure 1. Policy should focus on identifying ways in which LRA can contribute to alleviating each of the four dimensions of food insecurity shown in figure 1. Although the short-term supply dimension, in the form of drought-induced failures of food crops, is often the most visible component of food insecurity, the other dimensions are often more important. For example, for areas that are nor completely isolated, local food crop failure will not lead to hunger if the local population has sufficient income to buy food from outside; if hunger does occur, the real cause is a short-term

Problem Area	Food System	
	Supply	Effective Demand
Short-term Food Insecurity (transitory)	Macro actions: --Food Aid --Food Reserves --Stock Management Micro actions: --Breeding for yield stability (food crops) --Irrigation --Greater interregional integration	Macro actions: --Foreign Exchange Draw Down (IMF) --Emergency Income Transfer Micro actions: --Breeding for yield stability (food & nonfood crops) --Irrigation --Developing diversified income sources --Crop insurance
Long-term Food Insecurity (chronic)	--Increase Production & Marketing Potential, including poor's access to markets --Shift Composition of Production & Marketing Output	--Increase Income and Employment in both Agricultural and Nonagricultural Sectors

Figure 1. Dimensions of Food Insecurity and Measures to Deal with Them

decline in real income induced by the crop failure, not a shortage in (potential) supply. The supply and demand dimensions of chronic food insecurity are also massive problems, representing the problem of long-term hunger. Addressing those dimensions involves increasing the productivity (particularly labor productivity) of small-scale agriculture and of the closely related nonfarm elements of the rural economy. As argued below, this is likely to involve greater specialization within small-scale agriculture and greater reliance on externally provided inputs.

13. Viewing food security in this fashion emphasizes that food insecurity does not necessarily result from devoting acreage to export crops rather than food crops. Chronic hunger is primarily the result of poverty, and if reliable food markets exist, cultivating export crops may allow smallholders to increase their access ~~to food~~ more substantially, by selling the export crops and buying food in the market, than by directly producing food themselves. Furthermore, interactions between food cropping and cash cropping may increase small farmers food security in several ways. Research currently underway by the author and his colleagues in Mali suggests, for example, that households that cultivate both cotton (using substantial amounts of purchased inputs) and millet (under LRA conditions) have fewer food problems than farmers growing primarily millet, for the following reasons:

a. Cotton cultivation has financed the acquisition of animal traction equipment, which allows farmers to extend their area planted to food crops as well as to cotton.

b. Cotton has provided farmers a source of cash to pay certain expenses, such as taxes, without having to sell cereals immediately after the harvest. The farmers can then time their cereals sales for later in the year, when grain prices are higher. Farmers outside of the cotton zone more often sell cereals immediately after harvest, when prices are depressed, in order to meet their pressing cash needs, and they sometimes have to buy back grain for consumption later in the year when prices are much higher.

c. Fertilizer used on cotton has a residual effect on grain crops (millet and sorghum) that are grown in rotation with cotton.

d. Farmers use some fertilizer provided by the cotton parastatal directly on their maize crop.

e. Over time, the cotton industry has provided revenues for financing infrastructures, especially roads, that have also benefitted food crop marketing, as well as providing the foreign exchange to purchase imported agricultural inputs, such as fertilizer.

The experience of several Asian countries also supports the view that cash crops grown by small farmers can make substantial contributions to food security (Johnston, 1986, pp.159-60).

2. The Dynamics of LRA Development

14. There is strong consensus among agricultural economists and many general economists that economic development strategies for Africa should emphasize increasing the productivity of smallholder agriculture (Eicher, 1984, 1986a, 1986b; Lele, 1984, 1986; Johnston, 1986; Johnston and Hoben, 1986; Delgado and Mellor, 1984). Because most smallholders in Africa are engaged in LRA, there is agreement that LRA is the starting point for successful development strategies. Most of these economists reject the notion, however, that LRA should be the ending point for such strategies. Rather, they argue that there must be a progressive transformation of low-resource agriculturalists from reliance on a natural-resource based agriculture that depends primarily on internally generated inputs to a "science-based" agriculture that depends increasingly on externally provided sources of inputs, including new knowledge. This does not mean rapid farm consolidation and the utilization of highly capital intensive "lumpy" inputs (such as tractors) characterized by economies of size. Rather, these authors stress the need for progressive modernization of small farms, based on new technologies, such as improved seeds and fertilizers, that are highly

"divisible," complementary to labor, and hence suitable for use on small farms (Mellor and Johnston, 1984). Johnston (1986, p. 155) summarizes this view:

> In order to accelerate the growth of agricultural output, a shift from traditional resource-based agriculture to a science-based agriculture will be required, involving the utilization of more productive technologies and increasing quantities of fertilizers and other manufactured inputs.

15. This view draws heavily on the experience of several Asian countries, particularly Japan, Taiwan, and South Korea, which successfully based their economic development on a strategy of progressive modernization of small farmers. This section critically examines whether this strategy is appropriate for Africa, addressing the current contributions of LRA to incomes and food security in Africa and discussing the dynamics of LRA development.

a. LRA as the Starting Point

16. LRA in Africa, and even within individual African countries, is extremely diverse; hence, any attempt to generalize for the continent as a whole is dangerous. Nonetheless, there are some common features of LRA across countries. The USDA data indicate that a very large percentage of major crops in the 8 sample countries are grown under LRA conditions (see Table 1). Several patterns emerge from Table 1:

a. Within the arid and semi-arid areas of Africa, most of the basic staples (millet, sorghum, and fonio) are grown under LRA conditions. If data were available for cowpeas, they would show the same pattern.

b. A much smaller percentage of maize than millet and sorghum is grown under LRA conditions in all four ecological zones. This reflects the

Table 1. Production of Various Crops under LRA Conditions, by Zone, in 8 African Countries (Sudan, Senegal, Mali, Nigeria, Zaire, Zimbabwe, Kenya, and Malawi)

Crop	Zone				
	Arid, Semi-Arid	Seasonally Humid	Continuously Humid	Highlands	Total, All Zones +
FOOD CROPS					
Millet					
Total Prod. ('000 m.t.)	4289	385	N.A.	240	4914
% LRA	74	67		38	72
Sorghum					
Total Prod. ('000 m.t.)	3326	2238	N.A.	N.A.	5564
% LRA	62	59			61
Fonio					
Total Prod. ('000 m.t.)	54	N.A.	N.A.	N.A.	54*
% LRA	100				100
Maize					
Total Prod. ('000 m.t.)	1241	3468	891	1998	7598
% LRA	35	37	70	23	37
Rice					
Total Prod. ('000 m.t.)	194	956	1093	N.A.	2243
% LRA	45	67	90		76
Beans					
Total Prod. ('000 m.t.)	N.A.	103	68	N.A.	171
% LRA		22	90		49
Yams					
Total Prod. ('000 m.t.)	N.A.	4995	11655	N.A.	16650
% LRA		100	100		100
Cocoyams					
Total Prod. ('000 m.t.)	N.A.	333	1332	N.A.	1665
% LRA		100	100		100
Cassava					
Total Prod. ('000 m.t.)	N.A.	6806	18435	N.A.	25241
% LRA		92	93		93

Table 1 (Continued).

Crop	Zone				
	Arid, Semi-Arid	Seasonally Humid	Continuously Humid	Highlands	Total, All Zones *
EXPORT/CASH CROPS					
Groundnuts					
Total Prod. ('000 m.t.)	1882	658	237	N.A.	2777
% LRA	49	60	90		55
Cotton					
Total Prod. ('000 m.t.)	1835	208	N.A.	12	2055
% LRA	3	3		100	4
Coffee					
Total Prod. ('000 m.t.)	11	7	82	84	184
% LRA	0	100	100	100	94
Tea					
Total Prod. ('000 m.t.)	N.A.	N.A.	N.A.	126	126
% LRA				32	32
Sisal					
Total Prod. ('000 m.t.)	34	N.A.	N.A.	16	50
% LRA	0			0	0
Pineapples					
Total Prod. ('000 m.t.)	N.A.	N.A.	N.A.	155	155
% LRA				0	0
Tobacco					
Total Prod. ('000 m.t.)	N.A.	147	N.A.	N.A.	147
% LRA		0			0
Wheat					
Total Prod. ('000 m.t.)	N.A.	N.A.	N.A.	222	222
% LRA				0	0
Rubber					
Total Prod. ('000 m.t.)	N.A.	N.A.	86	N.A.	86
% LRA			58		58
Palm oil					
Total Prod. ('000 m.t.)	N.A.	22	663	N.A.	685
% LRA		99	78		79

SOURCE: D'Silva and Dommen, 1986. "Overview and Summary," Table 3.

NOTES:

N.A. indicates that no data were available on the production of the crop in the zone. In most cases, this signifies that the crop is not grown in the zone.

* The percentages shown in this column are weighted averages of the figures for each of the 4 zones. These percentages differ from those shown in Table 4 of the USDA "Overview and Summary" document. It is not clear how the latter were calculated, but they appear to be wrong.

spread of hybrid maize in east and southern Africa (particularly Kenya and Zimbabwe) and the greater fertilizer responsiveness of maize compared with millet and sorghum, which has encouraged farmers to use chemical fertilizers on the crop. In Kenya, 50% of smallholders grow hybrid maize and fertilizer use has reportedly doubled smallholder maize yields (D'Silva and Dommen, 1986, "Kenya Supplementary Information").

c. Most of the rice produced in Africa is produced under LRA, in spite of large, capital-intensive irrigation schemes in some semi-arid areas (e.g., Senegal and Mali), where over half the rice is produced under non-LRA conditions. Most of the LRA rice is either rainfed or produced in small, low-lying areas under gravity irrigation or seasonal flooding.

d. Almost all roots and tubers, which are extremely important staples in the humid areas, are produced under LRA conditions. This reflects the almost total neglect of these crops by agricultural researchers in Africa until very recently. With increased population pressure, one would expect a gradual shift towards these crops, as their caloric yield per hectare and per hour of labor is much higher than that of cereals.

e. In general, a much higher percentage of export and cash crop production takes place under non-LRA conditions than does food crops.[7] For example, virtually no cotton, sisal, or pineapples are grown under LRA conditions and only 32% of tea is. About half the production of groundnuts is reportedly produced under LRA conditions in semi-arid areas, where groundnuts are an important cash crop; in more humid areas, where they are grown more for home consumption, the share of LRA production increases.

f. The USDA figures indicate that almost all coffee and palm oil production in the sample countries takes place under LRA conditions. This reflects both the sample of countries chosen and problems with the data. In most cases the data did not allow USDA to distinguish between local and improved varieties of these perennial crops (D'Silva, personal communication). Much of the oil palm production in West Africa, particularly in Ivory Coast (the leading exporter of palm oil in West Africa but a country excluded from the USDA sample), takes place using improved high-yielding varieties, yet this is not reflected in the data. In addition, in some cases farmers may be using LRA techniques not because of they prefer them but because the systems for delivering modern inputs have broken down. (This apparently is the case for coffee and cotton in parts of East Africa.)

17. These findings reflect the greater attention paid to export crops both in terms of agricultural research aimed at producing varieties responsive to manufactured inputs and in terms of developing the supporting institutions (particularly input and output markets) that makes such a reliance on external inputs possible. Although it is commonly asserted that the Green Revolution has bypassed Africa, during the last 60 years agricultural research in Africa has resulted in very significant yield increases for three crops: oil palm, cotton, and maize (in eastern and southern Africa) (Eicher, 1984). These achievements are reflected in the low percentage of maize and cotton produced under LRA conditions (see the comments above on problems with the USDA oil palm data).

18. Agricultural research in Africa has been increasing at about the same pace as global agricultural research over the past 30 years; hence, sub-Saharan Africa's share of global agricultural research expenditures remained nearly constant between 1950 and 1980, at slightly less than 5%. Total spending in real terms on agricultural research in sub-Saharan Africa increased by a factor of 3.6 between 1950 and 1980, while the number of scientist person-years devoted to agricultural research increased by 4.3 times. (Judd, Boyce, and Evenson, 1983, 1986). Within sub-Saharan Africa, however, the distribution of research expenditures by country is very uneven, with Nigeria and South Africa accounting for 51% of total expenditures in 1980 (Judd, Boyce, and Evenson, 1983).

19. Compared with other parts of the world, countries in sub-Saharan Africa have put much more emphasis on extension relative to research. Extension expenditures per dollar of agricultural product were higher for East Africa than for any other geographical region of the world in 1980. (Judd, Boyce, and Evenson, 1983). It thus appears that African countries have to some extent tried to use extension as a substitute for research, especially for food crops. The danger is that if the extension service is not linked into a strong research program, the extension agents may have little that is valuable to extend.

20. Table 2 presents rough estimates of research expenditures by commodity, expressed as a percentage of the value of production of that commodity.* The data indicate that while certain export crops, such as coffee, cocoa, and sugar, have received substantial attention, food crops, particularly cassava and sweet potatoes, have been largely ignored, not only in Africa, but throughout the developing world. It is also striking that

Table 2. Research as Percentage of Product, by Commodity, for Selected Countries in Different Regions of the World (Average of 1972-79 Period)

	Region				
Commodity	Africa*	Asia	Latin America	All Countries**	International Centers
STARCHY STAPLES					
Wheat#	1.30	0.32	1.04	0.51	0.02
Rice	1.05	0.21	0.41	0.25	0.02
Maize##	0.44	0.21	0.18	0.23	0.03
Cassava	0.09	0.06	0.19	0.11	0.02
Potatoes	0.21	0.19	0.43	0.29	0.08
Sweet Potatoes	0.06	0.08	0.19	0.07	0.00
Field Beans	1.65	0.08	0.60	0.32	0.04
OTHER FOOD CROPS					
Vegetables	1.56	0.41	1.13	0.73	0.00
Soybeans	23.59	2.33	0.68	1.06	0.00
Citrus	0.88	0.51	0.57	0.52	0.00
EXPORT CROPS					
Cotton	0.23	0.17	0.23	0.21	0.00
Sugar	1.06	0.13	0.48	0.27	0.00
Cocoa	2.75	14.17	1.57	1.69	0.00
Bananas	0.27	0.20	0.64	0.27	0.00
Coffee	3.12	1.25	0.92	1.18	0.00
Groundnuts	0.57	0.12	0.60	0.25	0.005
Coconuts	0.07	0.03	0.10	0.04	0.00
LIVESTOCK					
Beef	1.82	0.65	0.67	1.36	0.02
Pork	2.56	0.39	0.60	1.25	0.02
Poultry	1.99	0.32	1.12	1.64	0.00
Other Livestock	1.81	0.89	0.42	0.71	0.00

SOURCE: Judd, Evenson, and Boyce, 1983.

NOTES:

* Egypt, Ghana, Kenya, Nigeria, Sudan, Tanzania, Tunisia, and Uganda

** 26 developing countries accounting for 90% of LDC agricultural research expenditures (excluding China)

# Most of the wheat research in Africa was carried out in North Africa.

## Includes millet and sorghum research for Africa (Evenson, pers. comm.)

livestock have received much more attention in Africa, relative to their economic value, than have food crops.

21. Although a much smaller proportion of export and nonfood crops are produced under LRA conditions than are food crops, there are important interactions between LRA and export/nonfood-crop production in addition to those already noted above (paragraph 13). In most African countries, the export crops are largely produced by small farmers, who also produce staples under LRA conditions. For example, the USDA data indicate that in Kenya smallholders produce 64% of coffee exports, 40% of tea exports, and nearly 100 percent of cotton exports (D'Silva and Dommen, 1986). Because food markets in rural areas are often unreliable, African smallholders usually give priority, in terms of labor allocation, to producing a high proportion of their families' basic food supply, allocating the residual labor and land to cultivation of cash crops, to livestock production, and to nonfarm activities. Low productivity in food production may therefore serve as a serious constraint on expanding export crop production, as a large proportion of farmers' resources have to be devoted to food production (Lele, 1986). Even in Malawi, with its large tea, sugar, and tobacco estates, smallholders accounted for 64% of the value of agricultural exports in 1979/80 (calculated from data in D'Silva and Dommen, 1986, "Malawi Supplementary Information"). There may also be important interactions between LRA and the estate sector through the labor market, as small farmers may be reluctant to work on the estates until they have assured that their home food production will be adequate.[9] Although African countries do need to encourage export crop production in order to generate badly needed foreign exchange and gain the benefits of specialization, necessary adjuncts to a strategy of export

promotion are improving the productivity of food crop production and/or increasing the reliability of food markets available to farmers--both of which imply substantial investment in the domestic food system.

22. Although export crop production is essential to generate the foreign exchange needed to finance development, another important way of generating (saving) foreign exchange is through import substitution. Given the burgeoning food imports into Africa over the last 20 years, food production represents the area in which most African countries have the greatest scope for import substitution. Improving the productivity of low-resource agriculturalists should play a key role in such an import-substitution strategy, as they represent the majority of staple producers.

23. The summary statistics compiled by USDA contain no information on livestock, although some information is included in the individual country studies. In most of the countries, livestock play an important role in the economy. In Mali, cattle are the second most important source of export earnings (after cotton), and livestock exports are important in Sudan and Kenya as well. Outside of the areas where white farmers historically settled (e.g., the Kenya highlands, Zimbabwe) cattle are raised largely under LRA conditions, although vaccinations are fairly common. Small ruminants are raised almost totally under LRA conditions and, relative to cattle, have been largely ignored by the veterinary services of Africa. Small ruminants, however, are usually a much more important source of meat in rural areas than are cattle, which are largely relied upon for milk, manure, and in some areas, animal traction. Data on poultry numbers are extremely unreliable for Africa, but in most instances the birds are raised under LRA conditions. Around major urban areas, particularly in Nigeria, Kenya, and Zimbabwe,

however, modern large-scale poultry operations have emerged. Although LRA poultry production will remain important in providing protein and income in rural areas, given the technical efficiencies of large-scale poultry production (which are much greater than in most other forms of agricultural production), the relative importance of LRA poultry production in peri-urban areas is likely to decline.

24. In much of Africa, particularly in semi-arid areas, unreliable feed supplies appear to be the most limiting factor on livestock production (Spencer, 1986). Crop residues and agricultural byproducts typically are the major sources of feed for nonruminant livestock and for ruminants during the dry season. Increasing the productivity in crop production therefore seems to be a prerequisite to greatly increased livestock production in LRA areas. This is likely to become even more true in the future, as human population pressure on traditional grazing areas is likely to result in a greater integration of livestock and cropping activities.

25. Research over the last 15 years has begun to document the importance of nonfarm activities in generating employment and income in rural Africa (Chuta and Liedholm, 1984; Kilby and Liedholm, 1986; Liedholm and Mead, 1986). Although rural nonfarm enterprises are typically very small, often employing only a single person, they account for a very large percentage of total manufacturing enterprises and employment in Africa--95% of all manufacturing enterprises and 86% of all manufacturing employment in Sierra Leone in 1976 were in rural areas, for example. In Ghana, rural small-scale industry accounted for 72% of total manufacturing employment, and in Zambia, 64%. (Kilby and Liedholm, 1986, Table 2). The available data indicate that nonfarm enterprises generate substantial contributions to rural incomes: 36% of total

rural household incomes in Sierra Leone came from these sources in 1974; for three villages in Northern Nigeria, the comparable figure was 28% (Kilby and Liedholm, 1986, Table 3).

26. Data from Africa and other parts of world indicate that rural nonfarm enterprises seem to make the largest percentage contribution to total household income among farmers with the least amount of land and those with the greatest, i.e., there seems to be a "vertical J" shaped relationship between the size of farm holding and the relative contribution of rural nonfarm enterprises to total household income (KIlby and Liedholm, 1986). For those with the smallest land holdings, typically low-resource agriculturalists, rural nonfarm enterprises may play a critical role in helping assure their food security. (See, for example, Loveridge, 1986). Nonfarm enterprises are particularly important as a source of off-season employment. Data from Nigeria indicate that nonfarm labor use during the dry season is 9 times that in the peak agricultural season (Norman, 1973). "The fluidity of labor between a number of activities on a seasonal basis is thus a striking feature of rural households" (Chuta and Liedholm, 1984, p. 298). In certain parts of the continent nonfarm activities are particularly important sources of income for women (e.g., the brewing industry in Botswana--see Haggblade, 1984).

27. Not only are these rural nonfarm enterprises important sources of income and employment for low-resource agriculturalists in Africa, the available evidence indicates that they are often more economically efficient than their large-scale urban counterparts. Furthermore, the demand prospects (as measured by income elasticities of demand) for many of the goods and services produced by rural nonfarm enterprises appear strong, indicating

considerable scope for their expansion in the future (Liedholm and Mead, 1986). The role of rural nonfarm enterprises and their relationship with small-scale farming are discussed further below.

b. The Potential Contributions of LRA/Small-Scale Agriculture

28. The greatest challenges facing agriculture in sub-Saharan Africa stem from the very rapid rate of population growth on the continent. Africa is the only major region in the world where the population growth rate is still increasing; it stood at 2.8% per annum between 1970 and 1982 and is projected to attain 3.3% p.a. between 1980 and 2000. In Kenya, the growth rate will attain a staggering 4.4% p.a. over this period, one of the highest in the world (World Bank, 1984, p.82). This means that food supplies must increase by 3.3% per year just to maintain present, inadequate, levels of per capita consumption. If per capita consumption increases, e.g., due to income growth, the needed increase in supplies will be even greater.[10] Yet per capita food production in Africa fell 12% between 1970 and 1984, and the decline has been more or less continuous over the past 20 years (McMillan and Hansen, 1986; Eicher, 1982.)

29. The alternative to producing food domestically is to import it, either through commercial imports or food aid. Food aid has risen enormously to Africa in recent years, but it is unrealistic to assume that it will continue to rise at a compound rate of over 3 percent through the end of the century.[11] Commercial imports require foreign exchange, which for many African countries derives heavily from export crops. Yet both the volume and the price trends for agricultural exports from Africa have been almost uniformly downward since 1970 (Table 3.) In many cases African exports of these commodities have fallen while world trade in them was rising, indicating that Africa has lost

Table 3. Volume and Prices of Agricultural Exports from Sub-Saharan Africa, 1961-82

Commodity	Volume (annual average growth rate in percent)				Price (annual average growth rate in percent)	
	Sub-Saharan Africa		World			
	1961-70	1970-82	1961-70	1970-82	1961-70	1970-82
FOOD & BEVERAGES						
Coffee	4.3	-1.0	2.3	0.9	0.3	1.8
Cocoa	-0.4	-1.2	0.5	-0.2	4.9	3.0
Sugar	4.4	1.2	1.2	3.1	-5.3	-2.7
Tea	9.5	4.0	2.4	2.1	-4.5	-2.8
Groundnuts (meal)	6.3	-4.6	1.1	-6.4	0.6	-4.1
Groundnut oil	5.4	-7.1	3.3	-0.4	0.1	-4.0
Beef	9.8	-7.0	5.6	4.6	6.8	-4.1
Palm oil	-9.7	-6.7	4.1	11.5	-2.3	-3.2
Bananas	-2.2	-6.6	4.9	1.0	0.1	-1.1
Maize	8.1	-6.9	7.1	8.6	-0.2	-4.2
NONFOOD						
Cotton	6.0	-4.0	0.8	0.9	-1.7	-1.9
Tobacco	-6.0	4.7	1.6	2.6	3.0	-1.2
Rubber	2.7	-3.8	2.9	0.9	-4.6	0.0
Hides and Skins	0.5	1.5	3.9	2.6	0.3	n.a.
Sisal	-1.8	-9.7	-1.7	-9.8	-8.4	0.1

SOURCE: World Bank, 1984, Table 12.

market share to other, usually lower-cost, producers.[12] All this points to the need to raise productivity rapidly in both food and export agriculture in order to meet Africa's food needs in the next 15 years.

30. Equally important, the rapid population growth implies a rapidly growing labor force. The labor force in sub-Saharan Africa is projected to grow at 3.2% p.a. between 1982 and 2000 (4.2% p.a. in Kenya) (World Bank, 1984, p.82). Modern industry has proven incapable of absorbing more than a small fraction of the new entrants to the labor market, so the bulk of the new workers will either have to find employment in the rural areas or attempt to squeeze out a living in the informal sector of rapidly growing cities. The challenge is not only to create 3.2% more jobs each year, but to increase labor productivity fast enough so that the demand for labor will grow more quickly than supply, resulting in higher returns to labor. Since most of the new entrants will have to find employment in rural areas, it is essential that the agricultural development strategy chosen generate substantial productive employment both in agriculture and in rural nonfarm activities.

31. Two critical questions regarding the agricultural strategy are therefore (a) what size distribution of farms is most likely to contribute to these goals and (b) once the desirable size distribution has been determined, what mix of low-resource and high-resource technologies should be encouraged?

The Size of Farm Question

32. Over the past 20 years a strong consensus has emerged among agricultural economists that in most developing countries, a development strategy focusing on the progressive modernization of the mass of small farmers is likely to generate both faster economic growth and a wider

distribution of benefits than a strategy that fosters the creation of large, capital-intensive farms and ranches. This consensus is based on substantial evidence that in most developing countries, small-scale agriculture: (a) generates much more employment per unit of capital investment than large-scale, capital-intensive agriculture, (b) is more economically efficient than large-scale agriculture, and (c) generates a pattern of effective demand for domestically produced industrial products and services that is more conducive to development of other sectors of the economy than is a "bimodal" strategy involving promotion of both large-scale and small-scale farms. This view has been most fully developed by Bruce Johnston, who argues that given rapid rates of population growth in Africa, "small is inevitable." (Johnston and Kilby, 1975; Mellor and Johnston, 1984; Johnston, 1986, Johnston and Hoben, 1986; Johnston and Tomich, 1985b).

33. Not only does a "unimodal" strategy focusing on progressive modernization of the mass of small farmers generate substantially more employment than a bimodal strategy, there is substantial evidence from throughout the world that when resources are priced at their true scarcity values (i.e., when subsidies are netted out), small farms are generally more economically efficient than large farms in developing countries (Johnston and Tomich, 1985; Berry and Cline, 1979). There is little evidence of substantial economies of size in farming in most low-income countries. Johnston and Hoben (1986, pp. 70-71) attribute the advantages of small farms to:

a. the greater incentive of farm family members, who are the residual claimants on farm output, to maximize farm profits (subject to risk constraints), compared with hired workers on large farms, who receive a fixed wage.

b. the difficulties in structuring incentives in large farms that rely on many hired laborers in a way that encourages decentralized decision making. The need for such decision making arises from the site- and time-specific nature of many decisions in farming.

c. small farms typically combining land, labor, and capital in proportions more appropriate to the relative factor endowments and relative factor prices of the country (since small farmers usually have less access to input subsidies).

d. the fact that "by relying on capital-saving and labor-using technologies, small farm strategies make it possible to increase farm output by fuller as well as more efficient use of their large and growing farm workforce, thereby minimizing the agricultural sector's requirements for the particularly scarce resources of capital and foreign exchange."

34. Even where, as in the case of a few crops such as tea and sugar, there are strong technological reasons for large-scale processing or centralized quality control, large-scale farms are not necessarily the most efficient way of producing these crops. Institutional arrangements, such as contract farming (e.g., through the Kenya Tea Development Authority), may allow smallholder production to be tied efficiently to large-scale processing and centralized quality control (Minot, 1986).

35. Moreover, a strategy of fostering small farm development generates a pattern of *effective demand* that not only improves the food security of the bulk of the rural population (see figure 1) but also stimulates the interactions between agricultural and industrial development. Whereas a large proportion of income going to large farmers typically is spent on imported

goods or heavy capital equipment, the spending pattern of small farmers is much more likely to favor local manufactures, particularly those from small-scale industry (King and Byerlee, 1978). The increase in purchasing power among the mass of small farmers creates a domestic market for local manufactures and thereby fosters the concurrent growth of agriculture and industry.

The Technology Question

36. A critical question is whether a low-resource strategy that depends primarily on internally or locally produced inputs can generate rates of growth of production among smallholders sufficient to meet Africa's pressing needs for food and remunerative employment during the coming years. Most economists are skeptical that a low-resource strategy by itself can achieve these results. As a result of increasing population pressure, many low-resource strategies currently used by African farmers are no longer adapted to the environment, and "as a result, major areas of land in Africa are being systematically mined and degraded" (Matlon and Spencer, 1984, p.672). Ruttan (1984) argues that the "conservation model" of agricultural development, which focuses on "the evolution of a sequence of increasingly complex land- and labor-intensive cropping systems, the production and use of organic manures, and labor-intensive capital formation in the form drainage, irrigation, and other facilities to more effectively utilize land and water resources," has historically proven incapable of supporting rates of agricultural growth much in excess of 1.0 percent per year (pp. 39-40). Although the conservation model was the major means by which agricultural productivity was increased in Asia and Europe until well into the 20th Century, rates of population and income growth (and hence demand for food)

were much lower then than now.

> The most serious recent effort to develop agriculture within this framework was made by the People's Republic of China in the late 1950s and early 1960s. It became readily apparent, however, that the feasible growth rates, even with a rigorous recycling effort, were not compatible with modern rates of growth in the demand for agricultural output, which typically fall in the 3-5 percent range in the less developed countries (Ruttan, 1984, p.40).

Nonetheless, as discussed below, there may be considerable scope to combine elements of the conservation model with greater reliance on purchased inputs in order to increase agricultural production in Africa in a sustainable way.

37. Further limitations of techniques relying primarily on internally generated farm inputs are that such a strategy limits the gains of farm specialization and may require the use of on-farm resources that have very high opportunity costs.[13] For example, low-input techniques such as composting are frequently labor-intensive, while African agriculture is characterized by seasonal labor bottlenecks (Eicher and Baker, 1982). For these techniques to be adopted, they need to be designed in a manner that recognizes the high opportunity cost of farm labor during certain key periods of the year. Similarly, incorporating crop residues into the soil may have a high opportunity cost to the farmer, as they serve as an important source of livestock feed.

38. A third factor that may limit adoption of new low-input techniques is that their benefits, in terms of improved soil fertility, reduced erosion, etc., often accrue only after several years. Poor people typically discount future returns heavily, as their immediate needs are so great. Therefore, the

design of such techniques need to assure some immediate benefits (e.g., firewood, as is available from alley cropping) as well as long-term benefits in terms of soil fertility. This may involve hybrid strategies that rely on both internally and externally provided inputs.

39. On the other hand, one can expect that in the short to medium term, African farmers will continue to rely on locally generated inputs to a greater extent than their Asian counterparts. The poor transportation network and fragmented input and output markets in Africa imply that the costs and risks of relying on a high-payoff input strategy is greater in Africa than in Asia.[14] Credit constraints may also severely restrict use of purchased inputs (Coulibaly, 1986). While the long-term solution lies in improving transportation and markets in Africa, in the short run one can expect greater reliance on strategies making use of locally available inputs.

40. There is also evidence from some areas of Africa that the payoff to increased use of chemical fertilizers is very limited without heavy applications of organic matter or moisture conservation techniques (Matlon and Spencer, 1984; Roth and Sanders, 1984; Ohm, Nagy, and Sawadogo, 1985). Hence, there may be considerable scope for development of hybrid strategies, such as use of tied ridges in combination with animal traction and chemical fertilizers or use of alley cropping, that combine both internally generated and externally provided inputs to increase agricultural productivity.

c. Implications of a small-farm strategy

41. Although there are strong reasons for adopting a unimodal strategy of agricultural development, increasing the productivity of millions of smallholders throughout Africa is a much more difficult task than increasing output on a relatively small number of large farms (albeit at high cost). A

development strategy based on small-scale agriculture will require substantial investment not only in technology generation but also in the supporting institutions that serve small farmers, particularly input and output markets. The current enthusiasm for "free markets" in Africa should not obscure the fact that markets in Africa are often fragmented and need substantial public investment in order to facilitate a well-functioning private trade (Lele, 1977; Shaffer et al., 1985; Jones, 1984). Extension services also need strengthening, with particular attention to building the link between extension and research, so that the extension service has recommendations that are likely to prove profitable under farmers' conditions.

42. In spite of recent increases in agricultural research expenditures in Africa (paragraph 18), our ignorance about smallholder agriculture on the continent is still vast, especially considering its heterogeneity. Therefore, "development of agriculture in Africa, as elsewhere, will be a brain-intensive process requiring significant investment in higher education to this end." (Delgado and Mellor, 1984). In addition to education, investment is needed in strengthening African institutions for agricultural research and education in order to strengthen capacity within Africa to generate new technologies suitable to small farmers, increase the supply of decision makers informed about smallholder agriculture, and build a constituency for policies (including research) that strengthen the rural economy.

d. Potential regional implications

43. If a small-scale agriculture strategy is successful in producing surpluses, mechanisms must be in place to use those surpluses productively and to assure prices that are remunerative to farmers. Again, the development of well-functioning markets and transportation systems, both within and across

countries, is essential to avoid local gluts and to develop reliable sources of demand for the products of small-scale agriculture. A major challenge is to tie small farmers to sources of effective demand for their products. This may pose regional problems because within a given ecological zone (e.g., the Sahel) farmers tend to produce similar products; hence, in years of good weather, nearly everyone has surpluses. Because consumers outside the region may not consume the same staples, there is a need to transform the products produced by small farmers into products for which there is a strong demand.

44. For example, from a trade perspective it makes much more sense for the Sahelian states to foster economic links with the coastal states of West Africa than with each other, as the Sahelian states all tend to produce the same mix of products and because the coastal states, with their much higher incomes, are potentially much more remunerative markets for a Sahelian country than are the other Sahelian states. (A basic premise of economics is that it is easier to get rich selling to rich folks than to poor folks.) Yet the staple crops produced in the Sahel (millet and sorghum) are little consumed along the coast. Hence, if reliable surpluses of these crops can be produced in the future, attention should focus on ways of transforming these cereals (e.g., through livestock production) into products for which there is strong demand in the south. Diversification also needs to be pushed to provide farmers alternative cash crops (for example, cowpeas) for which there may be strong market demand.

II. Implications of Ignoring Low Resource/Small-Scale Agriculture Development

45. Because of the rapid growth of rural populations in Africa, average farm size will inevitably fall during the coming decades. Failure to base a

development strategy on small-scale agriculture will perforce exclude the mass of the rural population from the benefits of development. Furthermore, as outlined above, concentrating on large-scale capital-intensive farming will likely lead to slower overall agricultural and industrial growth than a smallholder-based strategy. The size of farm question is likely to become increasingly critical during the next 20 years in Africa as population pressures lead to the emergence of land markets; once a latifundia-minifundia land-tenure system becomes codified in tradable rights to land, it is difficult to change.

46. In addition, ignoring small-scale agriculture will weaken the food security of African nations. Even if large farms in Africa were more efficient producers of food than small farms (which they generally are not), assuring food security is not simply a question of producing food. As shown in figure 1, a major component of food security involves increasing the effective demand for food among the poor by raising their real incomes. Since the majority of Africans are likely to live in rural areas for the next 20 years, it is highly desirable from a food security perspective to adopt a strategy that generates productive, remunerative employment in agriculture and rural nonfarm activities.

47. Rural-urban income disparities are already high in Africa, typically varying between 1:4 and 1:9, compared with ratios of between 1:2 and 1:2.5 in many Asian countries (Lele, 1984). These income differentials are the major force leading to the rapid rates of rural-to-urban migration that are so seriously taxing African cities. Failure to raise productivity of small-scale agriculture and rural industry will inevitably encourage even faster rates of rural-to-urban migration, as population pressure will, in the absence of new

technology, continue to push down per capita earnings in rural areas. Falling rural incomes may also make it more difficult to convince rural people to practice modern forms of birth control, as a family's best individual strategy in the face of high infant mortality and low-per capita earnings may be to have many children, hoping that some will survive to contribute to the family's earnings.

48. Furthermore, given the problems of declining soil fertility, desertification, and evidence that soils in at least some areas of Africa are unresponsive to chemical fertilizers without substantial inputs of organic material and water conservation techniques, there is strong justification for putting considerable emphasis on research into improved soil and water management techniques as part of a small-farmer agricultural development strategy. However, the case for a strategy that relies *exclusively* on on-farm or locally produced inputs is weak. A fundamental fact in Africa is that agricultural production will have to grow by over 3% annually just to keep pace with population. The "conservation model" of agricultural development has failed to produce such growth rates anywhere else in the world, even though in the other areas where it has been applied (e.g., China) there was substantially more surplus labor than in Africa to devote to these techniques, many of which are labor-intensive; there was more of a tradition of such techniques (China, South and Southeast Asia); and there was substantially more research into the techniques (India and China). While not belittling the importance of conservation measures as one component of a smallholder agricultural development strategy for Africa, the burden of proof is heavily upon those who argue that such techniques by themselves can generate adequate agricultural growth to meet Africa's pressing needs for food

and remunerative rural employment.

49. There is also a danger in believing that all smallholders, even within the same region of a country, face the same constraints. Smallholders are a heterogeneous lot, and their problems vary. For example, research in Mali has shown that the problems of low-resource farmers who have some animal traction equipment but not the full complement differ substantially from those of farmers in the same area who still are practicing hand hoe cultivation (see footnote 3). Again, there is need for a strong research program as one component of a smallholder development strategy in order to identify the constraints facing different classes of small farmers and to design solutions to relax those constraints.

III. Comparing African Agriculture with North American and Indian Agriculture

50. During the 1950s and early 1960s, U.S. foreign assistance to Africa was premised on the assumption that agricultural technology from the U.S. was directly transferable to Africa (Johnston and Hoben, 1986). In most cases this was not true, as the North American technology had been developed as an adaptation to an environment very different from that of Africa with respect to climate; disease problems; relative prices of factors of production, particularly capital and labor; existence of supporting infrastructure, such as repair facilities, input markets and trained personnel; and level of education of the people who were to use the technology. As a result, many of the attempts to transfer North American agricultural technology directly to Africa failed.[15]

51. More recently, several authors have drawn parallels between the situation in South Asia, particularly India, during the mid-1960s and the current situation in sub-Saharan Africa (see, for example, Lele, 1984). In

the mid-1960s India faced massive food problems, was heavily dependent on emergency food aid, and was often written off as a "basket case." Today, while much of sub-Saharan Africa faces seemingly similar problems, India is exporting food (including food aid to Africa) and is being hailed in the press as a rising industrial power. Although many Indians are still malnourished, India has made substantial progress in addressing its food problems. This section briefly examines the similarities and differences between African agriculture and that of North America and India in order to draw inferences about what lessons can be learned from India and North America to help develop African agriculture. More attention is given to the comparison with India, as most observers now recognize the limits to transferring North American agricultural technology directly to Africa.

A. Differences between African and North American Agriculture

52. Direct transfer of North American agricultural technology to Africa has usually failed partly because the physical resource base in Africa is so different from that of North America. Not only are different plant and animal diseases present, tropical climates create special problems of controlling diseases and insects (for example, there are no cold winters to kill off many pests). Tropical soils are often very fragile, requiring management techniques very different from used in the U.S. Because of these physical differences, many U.S. crop varieties and animal breeds have performed very poorly when transferred to Africa. In addition, much of the supporting infrastructure upon which North American agriculture depends, including well-functioning input and output markets, repair facilities, veterinary health services, etc., is absent in Africa, which makes the direct transfer of U.S. agricultural technology even more problematic.

53. Differences in the economic and social environment also limit the direct transfer of technology. Particularly important are differences in the relative prices of factors of production. In North America, capital is relatively cheap compared with labor; hence has often proved economical to develop capital intensive techniques of farming, as such techniques allow farmers to replace relatively expensive labor with cheaper capital. In Africa, in spite of seasonal labor bottlenecks in some places, the price of capital relative to labor is much higher; consequently, such highly capital-intensive farming methods are inappropriate, as they encourage replacement of relatively cheap domestic labor by expensive imported capital equipment. Where such techniques have been adopted in Africa, adoption has usually resulted from heavy government subsidies to imported capital (e.g., in the form of overvalued exchange rates).

54. There are nonetheless lessons from the North American agricultural development experience that may be useful for Africa, particularly regarding the development of supporting institutions, such as the Soil Conservation Service, Colleges of Agriculture, etc. One must be extremely dubious, however, about attempts to transplant a model of North American agriculture directly to Africa.

B. Differences between African and Indian Agriculture

55. It is unrealistic to expect the Indian experience to be rapidly duplicated in Africa. Indeed, some of the most useful lessons from the Indian experience for Africa can be drawn by highlighting the differences between India of the 1960s and Africa of the 1980s.

1. Differences in the Physical Resource Base

56. The dramatic gains in agricultural output in India over the past 20 years have been heavily concentrated in the Punjab, an area of northern India with relatively fertile soils and a geology that permitted the widespread adoption of tubewell irrigation. The high-yielding dwarf wheat varieties developed at CIMMYT in Mexico and imported to India in the late 1960s performed very well in "irrigated deserts" like the Punjab, where water control was good and pest problems were low. (Improved rice varieties, developed at IRRI and widely adopted throughout many parts of Asia, also perform much better under conditions of good water control.) In contrast, African agriculture is characterized by an enormous diversity of agroclimatic and soil conditions and a heavy reliance on rainfed agriculture. Whereas over 20% of India's cultivated area is irrigated, in Africa, the comparable figure is 3-5% (World Bank, 1982; Eicher and Baker, 1982).[16] Much of Africa's irrigated area lies in highly capital-intensive schemes in semi-arid areas, where the investment cost per hectare often runs 5 times that of comparable schemes in Asia (World Bank, 1982; Koita, 1986).

57. In the high rainfall areas of Africa, agricultural production is limited by low solar radiation, leaching of soil nutrients, soil degradation that often occurs when the vegetative cover is removed, and the rapid spread of pests and diseases that results from continuously hot and humid conditions. In semi-arid areas, rainfall is the main constraint on production. Compared with semi-arid areas of India with similar levels of rainfall, West Africa tends to have a shorter growing season with greater risk of drought. (Matlon and Spencer, 1984). This means that shorter cycle varieties (which are generally more risky) are needed in Africa and that seasonal labor bottlenecks

are likely to be much more severe in African agriculture than in India. "Moreover, African soils tend to be shallower, have poorer texture, are more inert, and have lower water-holding capacities than comparable Indian soils" (Matlon and Spencer, 1984, p.672).

2. Differences in the Crops

58. The environmental conditions of the Punjab allowed India to import the improved CIMMYT varieties and adopt them quickly to local conditions. The CIMMYT and IRRI successes with rice and wheat were partly a function of plant breeders' ability to develop photo-period insensitive varieties that could be adopted over a wide geographical area. No such varieties seem to be on the horizon for millet, sorghum, or maize, the main cereal staples in Africa. In addition, ICRISAT has had little success in introducing improved Indian sorghum and millet varieties into West Africa because of disease and pest problems, and water control problems have prevented introduction of dwarf rice varieties. (After 10 years of variety trials in West African mangrove swamps using over 2,000 imported varieties, WARDA found only two varieties that performed as the best local varieties (Spencer, 1986).)

3. Differences in the Economy, Infrastructure, and Human Resources

59. The spread of the new varieties in India was also fostered by a better transportation network and much better integrated input and output markets than exist in Africa. (See Jones, 1984, for data comparing the degree of integration of Indian and African cereals markets). This is partly a result of the greater population density in India than in sub-Saharan Africa. Paradoxically, although the rapid population growth rate in Africa poses serious problems for agricultural development, so does the low population density in many areas.

60. Another important difference is that while India is a large, relatively closed economy, African economies are typically small and heavily dependent on foreign trade. Small countries have serious problems of assembling a critical mass of scientists to work on agricultural problems; hence, regional research will have to play a much larger role in Africa than in India. Regional research does not solve all the problems of smallness, however. Whereas Indian political leaders took a decision early on to concentrate agricultural research expenditures on a single high-potential area (the Punjab), this type of decision is often politically impossible if several countries are involved, as it may leave some of the participating countries with little agricultural investment or research at all. Moreover, regional research is often very difficult to coordinate. The openness of the economies means that they are very susceptible to fluctuations in international prices, particularly of their main export products. Because government revenues, and hence budgets for agricultural research, are usually highly dependent on export earnings, this openness translates into highly unstable research budgets.

61. A key factor in India's success in agricultural research was the very heavy prior investment that the country had made in human capital and in developing the research and training institutions that generated both trained personnel and knowledge about the country's agriculture. Until recently African countries have made only meager investments in training agricultural scientists and building research and training institutions (Eicher, 1982, reports that between 1952 and 1963 only 4 university graduates were trained in agriculture in all of Francophone Africa.) In contrast, India, via the British colonial government, began building colleges of agriculture in the

1920s. Consequently, by the early 1960s Indian policy makers and agricultural scientists were very knowledgeable about the nature of the agricultural problems facing the country, where the highest payoffs to research were likely to be, and which parts of the country had the greatest agricultural potential. This focused the policy debate, and once a decision was reached about where to invest, it permitted much more efficient use not only of domestic research resources, but of foreign assistance as well. The Indians could define the problems facing agriculture, identify subject matter areas where they needed outside help (e.g., a consultant in soil chemistry) and then provide a knowledgeable local team of scientists to work with the outside expert (Billings, personal communication).

62. In contrast, in much of Africa, the lack of trained personnel and knowledge of local agricultural conditions severely limits the effectiveness of foreign assistance. Development efforts are frequently planned on the basis of very weak data, and often every step of the process, from project identification through implementation, is in the hands of expatriates. This by necessity restricts ~~the~~ amount of local knowledge that gets incorporated into the projects and greatly limits the benefits of "learning by doing" that would result if local personnel were more intimately involved. Because expatriates are usually on the job only for a few years, many of the lessons learned in project implementation are lost when the project personnel return home; hence, mistakes often are repeated time after time in different projects.

63. A further consequence of India's heavy investment in personnel trained in agriculture was the emergence of an educated lobby for agriculture in policy- making circles in India during the 1960s. Such a lobby is absent in

most African countries.

64. Relative factor prices are also quite different in Africa than in India. In India, land is clearly the scarce factor of production, while labor is abundant. Consequently, it was clear that agriculture needed land-augmenting, labor-using technology, which is exactly what the new grain/fertilizer technology represented. In Africa, seasonal labor bottlenecks and highly variable rainfall are major constraints, while labor is abundant at other times of the year. Hence, Africa's most pressing current agricultural needs are technologies to relax these constraints (e.g., selective mechanization and varieties that are bred for yield stability). As population pressure increases, however, the need for more land-augmenting, labor-using technologies will increase.

4. Lessons for Africa

65. Perhaps the greatest lesson for Africa from the Indian experience is that progress in overcoming food problems in poor countries is possible, but it is a long-term process that depends not so much on the importation of new technology from abroad, although that may be important, but on developing indigenous knowledge about agriculture and capacity (human capital) in the agricultural sciences and in policy analysis. These allow a country to borrow judiciously from abroad and adapt foreign technologies to local conditions, as well as to develop new technologies locally. Developing this knowledge and scientific capacity in Africa will require long-term commitment to graduate education of Africans in agricultural sciences and to strengthening African faculties of agriculture and research institutions. Yet without this capacity, the effectiveness of foreign technical assistance is likely to remain low. In addition, India's experience demonstrated that

technology by itself is not enough; supporting institutions, such as well-functioning input, factor, and output markets are extremely important in fostering growth in agricultural production and rural incomes.

FOOTNOTES

1. Some of the characteristics listed in the OTA definition are debatable, notably the statement that LRA is "low cost" and "adapted to local envionments and cultures." As argued below, a key characteristic of LRA in Africa is low productivity (particularly low labor productivity), which implies high unit costs of production, even though total cash costs are low. In addition, although LRA evolved as an adaptation to the local environment and culture, that environment is not static and imbalances between current LRA practices and the environment can arise, most notably due to population pressure. One of the challenges for LRA in Africa is to evolve in a fashion consistent with the changing environment.

2. On the weaknesses of the aggregate data on agriculture in Africa, see Eicher and Staatz (1985), Lele (1984) and Eicher (1982). D'Silva reports that for a few countries (e.g., Sudan, Malawi, parts of Zimbabwe, and Kenya) aggregate data do exist that classify farmers according to their degree of modern input use. Not all these data are available in the U.S., however.

3. Research currently under way by the author and his colleagues in Mali indicates that farmers who grow millet in rotation with cotton are well aware of the residual effects of cotton fertilizer on their millet crop. They state that were relative prices more favorable, they would consider applying fertilizer directly to the millet. (This research is being carried out under the Food Security Cooperative Agreement between USAID, Bureau of Science and Technology and Africa Bureau, and the Department of Agricultural Economics, Michigan State University [Contract no. DAN-1190-A-

00-4092-001).

4. Gender issues may be important here. If cash crops and credit to purchase modern inputs are largely in the hands of men, while women concentrate on production of food crops, there may be barriers to greater use of modern inputs on food crops.

5. Defining the cut-off point for this standard amounts to defining a poverty standard for the country. For the issues involved in doing this, see Krishna, 1973. Such a standard would be more useful for defining LRA within a given country than across countries due to problems of noncomparability of prices across countries and of determining appropriate exchange rates for intercountry comparisons. Following the standard procedure of farm-management studies, such calculations would impute values to home-consumed production using farm-gate prices.

6. Effective demand refers to demand that is backed up with enough purchasing power to allow the consumer to satisfy the demand through the market. References to the "demand side" of food security in the following paragraphs refer to effective demand.

7. The distinction between food crops and export or cash crops is not always clear-cut. For example, groundnuts are grown both as an export crop (particularly in semi-arid areas) and as a food crop.

8. The data on research expenditures by commodity have to be estimated indirectly, and are very rough. Furthermore, they vary considerably by source. For example, Evenson (1981) estimated that research expenditures on cotton in developing countries totaled 3.5% of the value of production, contrasted with an estimate of 0.21% in table 2. Evenson (personal communication) considers the latter estimate more reliable. I am currently attempting to obtain additional unpublished work on agricultural research in Africa from Evenson and from Peter Oram at IFPRI and will incorporate it in the final revision of this paper.

9. These interactions between export crops and food crops are often overlooked in the debates between donor organizations, like the World Bank, which argue that African countries should exploit their comparative advantage by emphasizing export-crop production and African governments, which generally stress food self-sufficiency in their policy statements. See, for example, World Bank, 1981 (the Berg Report), and Organization of African Unity, 1980.

10. The general formula for estimating the annual growth rate in the demand for food is:

$$r = p + ny$$

where

r = annual rate of growth in demand;
p = annual population growth rate;
y = annual rate of growth in per capita income; and
n = income elasticity of demand for food (often 0.5-1.0 in LDCs).

11. Per capita food aid to eleven major countries in Africa rose from 1.6 kg. per year in the 1966-70 period to 11.6 kg. per year in the 1981-83 period (Shapouri, Dommen, and Rosen, 1986, Table 25).

12. In a few instances (e.g., beef), Africa may have lost market share due to expansion of the EEC, not because competing countries were lower-cost producers. Also, within Africa, export performance varied widely by country. For example, Ivory Coast greatly expanded its share of the world cocoa and palm oil markets, while the shares of Ghana and Nigeria fell precipitously.

13. Historically, increased agricultural productivity throughout the world has been accompanied by a process of specialization, as farmers increasingly rely on purchased inputs rather than producing inputs on the farm (e.g., the shift from animal traction to tractor power in the U.S.). This increased farm specialization usually involves all three of the fundamental sources of growth in agricultural output and rural incomes: more efficient use of existing factors of production; the development and use of new factors of production (technological change); and changes in institutions, which alter the incentives and rights to use existing factors of production and develop new ones.

14. The "high-payoff input strategy" is a strategy of agricultural development that depends on the provision to farmers of "high-payoff inputs" such as improved varieties and chemical fertilizer (see Ruttan, 1984).

15. Not all transfers of agricultural technologies from the Americas to Africa have been failures. Two extremely successful transfers involved the introduction of maize and cassava into Africa by the European explorers of the 16th Century. More recently, high-yielding varieties of cowpeas from the San Joaquin Valley of California have been successfully introduced into Senegal. (Ouedraogo, personal communication).

16. Some of the irrigated area in India has come into production since the mid 1960s as a result of the higher returns to irrigation made possible by the new wheat and rice varieties.

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September 29, 1986

PROGRESS REPORT FOR OTA

PAPER ON LOW-RESOURCE AGRICULTURE IN AFRICA

by

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I. Introduction

I was pleased to be asked to participate in the study because the role of low-resource agriculture (LRA) in sub-Saharan Africa and U.S. policy towards it are extremely important. I have also been impressed with the recognition in OTA's earlier work (1,2) of the complexity of the issues surrounding LRA in Africa.

However, after looking closely at the statement of work for the paper and contrasting it with the USDA statistical profile of LRA in eight African countries, I am uneasy about whether I (or anyone else) can fulfill the terms of reference. My major concern is the following: the statement of work specifies that (a) "The analysis will be based on the statistical profile prepared by USDA" and (b) will answer a number of specific questions regarding the potential contributions of LRA in Africa and the major constraints to the realization of that potential. The problem is that most of the information needed to answer these specific questions is not contained in the statistical profile. This progress report outlines my concerns and sollicits the suggestions of OTA staff and the advisory panel on how to resolve the problem. I also raise some conceptual issues that I think the paper will need to address.

II. Concerns Regarding the Assignment

A. Correspondence between the Statistical Profile and the Questions Asked

The two OTA documents cited above summarize much of the current thinking of researchers and development practioners regarding the potential of and constraints to low-resource agriculture in sub-Saharan Africa. The current paper should not simply resummarize that current thinking. Presumably, in commissioning the statistical profile, OTA sought to move the analysis into a more quantitative phase. However, the relationship between the data provided and the questions asked in the work statement is not clear.

Theoretically a statistical profile of LRA could:

1. Provide information on the role of LRA in the economies of specific countries. This information ideally would include both historical data and a current "snapshot" of the absolute and relative importance of LRA in terms of:
   a. the numbers of people involved;
   b. its production of various agricultural products;
   c. its links to the rest of the economy--for example, the share of domestic food and fiber supplies and exports produced by LRA; the income and hence the

demand for nonagricultural products that LRA generates.

2. Provide profiles of "typical" low-resource farmers and outline their activities and constraints. Given the diversity of LRA within even a single country, several such profiles would be needed per country. Ideally these profiles would provide information on:
    a. the farm and nonfarm activities of the household members, differentiated by age and gender;
    b. the production techniques used, ideally accompanied with enterprise budgets;
    c. access of the households to input and output markets.

Even with all this information (which the current statistical profile falls far short of providing--simply because in many cases such data do not exist), one could not respond to the questions asked in the Statement of Work. A good deal of additional information is needed. This is seen by examining some of the questions asked:

2. Evaluate the contributions/limitations of low-resource agriculture for improving quantity, quality, and stability of food production.

    Answering this question requires knowledge not only of the current status of LRA (as might be provided by the statistical profile) but above all knowledge of the potential roles LRA could play in the future to improve food production. This in turn requires knowledge of many things not contained in the statistical profile--e.g., what technology applicable to LRA is "on the shelf" or close to being so, and how well the supporting institutions serving LRA (the extension service, etc.) work in these countries. On the basis of the current statistical profile one can make some statements about LRA's present contribution to the food system in these countries, but beyond stating the obvious fact that in countries where LRA is dominant it will of necessity be around for some time to come and hence play an important role in the economy, there is little in the data base itself that allows one to go beyond the statements in the previous OTA studies regarding LRA's future.

4. Evaluate the contributions/limitations of low-resource agriculture for broader goals of national development:
   a. Can it generate surplus income for investment in other sectors? How?
   b. Can it ensure local, national, and regional food security? How?
   c. What can be done to ensure equitable food distribution if food is produced as part of a low-resource agriculture strategy?

Answering these questions requires a good deal of information beyond that contained even in an ideal statistical profile of

LRA. The answers require the author to draw primarily on his or her knowledge of agricultural policy, hypothesize about marketing and food security strategies, etc. One can certainly draw in passing references to the relative importance of LRA, as shown by the statistical profile, but the main source of information will be the author's other knowledge.

Similar comments apply to questions 5-7 in the statement of work. The statistical profile provides little information on the constraints facing low-resource farmers, hence one cannot rely on it to talk about whether, for example, government should subsidize rock phosphate production, let alone how such subsidies should be implemented. (Answering that question would require, among other things, fertilizer trail results.)

In summary, I am having difficulty seeing how to make the paper more than just a thinkpiece on LRA and make it truly _an_ interpretive summary of the statistical profile. I am quite willing to do a thinkpiece, but I don't believe that is what OTA wants. I welcome your suggestions.

B. Other Concerns About the Statistical Profile

1. USDA's Definition of LRA

USDA has adopted a very conservative definition of LRA, stating that low-resource agriculturalists are those who use _no_ modern inputs, such as fertilizer, and no modern production technology. Even if one accepts this very conservative definition, there are problems in making it operational. For example, in many parts of Africa, cash crops, such as cotton, are grown in rotation with food crops, such as millet. The cotton receives fertilizer and pesticides, which have some residual effect on the following millet crop. Does one count this millet as being produced under LRA? More importantly from a policy perspective, does one count the farmers as low-resource farmers?

2. The Quality of the Data

Data on LRA in Africa area very weak, a point emphasized in previous OTA publications. This shows up in some of the USDA figures. For example, the LRA area reported for millet in the semi-arid zone of Mali exceeds the total millet area for this zone. Similarly, the yield of millet under LRA exceeds the yield in non LRA, which seems questionable. Several such problematic figures exist. There is also a need to distinguish between missing data and zeros. Currently, if a column reports zeros, one does not know if that means there is really none of that crop produced or if there are simply no data. For example, cowpeas are produced the the semi-arid zone of Mali, but zeros are entered in the cowpea columns for Mali, presumably because no data were available.

Given the diversity of LRA within countries, there is also a danger of relying on one or two micro studies as indicative of what "typical" low-resource farmers do. Again, the Mali statistical profile is an example.

III. A Few Key Issues to Address in the Analysis

An analysis of the potential of LRA will need to come to grips with the following issues:

A. Distinguishing between LRA and Small-Scale Farming

LRA is not necessarily synonymous with small-scale agriculture. (This is a distinction that the country annexes prepared by the USDA fail to make. Most of the distinctions are between small farmers and large farmers.) Japan, Taiwan, and South Korea, for example, followed agricultural development strategies that were based on the progressive modernization of small (1-5 ha) family farms. Much of the seed and fertilizer technology that characterized the green revolution in Asia was scale-neutral and hence was widely adopted by small farmers. Similarly, in many parts of Africa, export crops (e.g., tea in Kenya) are produced by smallholders who use modern inputs.

There are at least two possible strategies for LRA in Africa:

a. Attempt to follow a Japanese-style strategy of progressively introducing new technologies based on improved seeds, agrochemicals, and other manufactured inputs to small farmers currently engaged in LRA. This strategy requires the strengthening of a number of supporting institutions, such as extension and input markets, and implies progressive integration of low-resource farmers into the market economy.

b. If one assumes that in the short to medium term, modern inputs will not be available to most low-resource farmers and that the supporting institutions and markets will not function well, then an alternative strategy is to try to develop more "low-input" technologies that require fewer purchased inputs and supporting services. A critical question is whether appropriate low-input, low-cost, high-output technologies really exist or can be developed in the near future.

requires some support for delivery

The analysis should address the pros and cons of these two alternative strategies.

B. LRA is not Always Low-Cost Agriculture

Although total purchased input costs of LRA are low, the cost of production per unit of output is not always lower than in more "high-tech" agriculture. Even though total input costs increased with the introduction of the new wheat and rice varieties in Asia, per unit costs of production fell substantially. In addition, one has to ask "whose costs are being counted?" Where population pressure is great, LRA may impose substantial social costs in terms of environmental degradation, which need to be taken into account. The analysis has to address the cost issue carefully.

C. LRA Exists in a Dynamic Setting

LRA evolved as an adaptation to local environmental and social conditions. These conditions are changing, particularly because of population pressures; hence, LRA practices that were appropriate in the past (e.g., shifting cultivation) may no longer be appropriate in certain situations. The analysis needs to bear in mind the need for LRA to evolve along with its environment.

CITATIONS

1. OTA. *Africa Tomorrow: Issues in Technology, Agriculture, and U.S. Foreign Aid: A Technical Memorandum*. Washington: December, 1984.

2. ___. *Continuing the Commitment: Agricultural Development in the Sahel*. Washington: August, 1986.

Contract Paper No. 2

FINAL DRAFT

LOW-RESOURCE AGRICULTURE IN AFRICA

OTA Technical Paper Series: Potentials for Development
Low-Resource Technologies for African Agriculture

by

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Congress of the United States
Office of Technology Assessment

April 1987

FINAL DRAFT

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LOW-RESOURCE TECHNOLOGIES FOR AFRICAN AGRICULTURE

Charles A. Francis

(Summary Paper on Potentials for Development)

Executive Summary

1. Workshop Decisions. A two-day meeting of the Advisory Panel on Low-Resource Agriculture (LRA) in Africa was held September 29-30, 1986 to discuss the USDA overview/summary report and statistics. This report and the eight specific country summaries provided core information to quantify the importance of low-resource agriculture in Africa. The panel concluded that the USDA report provides useful background information as a first step toward better understanding the complexity of production constraints in the eight countries studied. There is no attempt in the report to move beyond these data to suggest strategies for development. Of the five goals given for this OTA Assessment, the report partially addresses only the third goal, "to determine the nature and magnitude of low-resource agriculture", and the report actually says little about the nature of LRA. The panel and OTA staff decided that Staatz and Francis would develop comprehensive papers based on the data in the USDA report and the panel discussions during the two-day meeting.

2. Summary Paper. The USDA summary report provides data on 22 important crops in four agroecological zones for eight countries in Sub-Saharan Africa. Although this sample of countries is small in number, the countries are large and important producers of key food and export crops in the region. They represent from half to three-fourths of the area and production in the entire region of millet, sorghum, groundnuts, maize, sesame, cassava, yams and cocoyams. Thus the sample is large enough to suggest valid conclusions, assuming accuracy in the data and analyses. Low-resource agricultural systems produce the majority of millet and groundnuts, and more than 90% of the cassava, yams, and cocoyams in the sample countries. The choice of countries and data brought together in the report provide a large and valid sample of important crops and agricultural systems on which to base an assessment of how crops are currently grown in the region.

3. Country Supplements to Overview Report. An important part of the USDA report consists of eight country-specific summaries of national agricultural statistics, and these provided valuable detail for the advisory panel. Any reduction of data into further summary form implies a loss of information. Given the location specificity and individual crop differences in production constraints, and the range of alternative solutions needed to increase production and incomes, these country reports provide a rich background of data on each agroclimatic zone and each crop within the country. The reports will be valuable to specialists designing research and extension activities in each

country, as well as decision makers who are planning development strategies for the region.

4. Important Message. There is no single nor simple solution. Africa is a highly diverse continent in terms of rainfall, soil fertility, crops and cropping systems. There is even more diversity in peoples, political and social systems, natural resources, and economic status — this diversity is apparent among countries, among regions within countries, and among farms in many regions. In this complex agricultural, economic, and social environment it is difficult to seek appropriate and widely applicable technologies such as those developed for the "green revolution" which have been successful in some parts of Asia. In addition, the levels of resources needed to implement most new technologies are unavailable and inaccessible to most small farmers in Sub-Saharan Africa. Thus, a directed and intensive search for technologies which can be used in current systems and which depend on efficient use of resources internal to the farm is critical to future development of sustainable food production systems. This is the most realistic approach to solving the current and continuing food crisis on the continent, and one which must be implemented with a large number of small farmers. The change in emphasis toward more efficient use of internal resources and the promotion of more sustainable production practices has long-term positive implications for improvement of the production environment, and will help guide a total development effort which can meet current and future needs for food and other agricultural products in Sub-Saharan Africa.

Contributions and Limitations of LRA to Food Production

5. Nature of Current Systems. There is ample documentation of both the crisis in agriculture and the nature of current production systems in Africa (Commins et al., 1986; OTA, 1984, 1986; Timberlake, 1985). Using the definition of USDA for LRA, "any agricultural production process in which no modern inputs are utilized", and their summary report, it is apparent that the majority of food crops for basic nutritional needs are produced in the sample countries under low resource conditions. Table 1 summarizes the areas dedicated to basic food crops and to specialty crops in the eight countries. This data was taken from the USDA report and aggregated for cereals, grain legumes, starchy roots, and specialty crops which are often grown as plantation species. From the summarized data, it is possible to draw some general observations about current food production systems in Sub-Saharan Africa.

6. Quality of Data in Report. We must conclude that data from most sources in Sub-Saharan Africa are subject to question, due to the range of conditions under which statistics are collected and the lack of infrastructure which makes this a difficult task. The information in the summary can be no better than the quality of the data which went into this analysis. As the authors of the USDA report point out, the information comes from a wide range of sources, from different ministries, from agencies which use both primary and secondary sources, and from some organizations ill-equipped to gather precise figures on area and production.

There is undoubtedly some variability in the quality and credibility of information. It is likely that some data sets may be adjusted before publication for economic or political reasons. We must assume that this is the best information available to the ERS/USDA team. It is possible that FAO production data or that from World Bank and other sources could be used to improve some of the estimates. For the moment, we can operate under the assumption that this is a reasonable "best available" data set, and one on which we can base some preliminary conclusions about LRA in Africa.

7. Area Dedicated to Major Crop Groups. The predominating influence of cereal grains in the arid, semi-arid, seasonally humid, and highland zones is apparent from Table 1. With the exception of wheat, all these cereals are important for low-resource farmers, although the relative importance of each cereal varies with country and with agroecological zone. Millet is most important in arid/semi-arid regions, sorghum in the seasonally humid regions, and maize in the continuously humid and highland regions. Groundnut is the predominant grain legume in all lowland regions where legumes form an important part of the cropping systems. Cassava is the most important starchy root crop, although yams and cocyams are also significant components of the systems in more humid lowland regions. A range of specialty crops have importance in one country or another -- and these are low-resource crops in some countries and high-resource crops in others.

8. Validity of the Data Set. Based on general knowledge of cropping systems in Africa and other references, I conclude that this summary of major crop production areas represents a good overview of crop distribution and importance of low-resource agriculture in the countries surveyed and in the region. There are some omissions which should be noted. Cowpeas are an important basic food crop in Nigeria, for example, and do not appear in the data summary. There is a table for "beans" in the country report, and perhaps this really represents cowpea area and production. Likewise, there is no mention of the banana or plantain area or production in the summary report, in spite of their importance in much of the lowland humid area of Sub-Saharan Africa. Without the inclusion of these important subsistance crops, certainly of importance to low resource farmers in the region, the report cannot be considered definitive. Perhaps the use of FAO and other data base information on crops and cropping systems could improve the estimates and lead to a more valid assessment of current potentials of LRA.

9. Intercropping and Subsistance Farming in LRA. There is no doubt much difficulty in obtaining accurate information on the areas dedicated to crops in Sub-Saharan Africa. In arid and semi-arid zones, the sorghum, millet, and cotton may be grown in a range of intercropping patterns, especially by low-resource farmers. There are probably more accurate estimates of cereal area when these crops are grown in monoculture, as with cotton in much of the region or the sorghum in Sudan under non-LRA conditions. Because of the lack of good estimators for

intercropped land, and the isolation of many LRA producers from normal channels of communication, we could conclude that data presented in the country reports and in the summaries will underestimate the contributions of LRA to total area and crop production.

10. Importance of Food and Non-Food Crops. Table 1 also provides an overview of the importance of basic food crops versus non-food or specialty crops. Conventional wisdom in development circles tells us that a disproportionate emphasis has been given to development of technology and an expansion of area dedicated to export crops — at the expense of important basic food crops. It has been documented that export crops have increased in production and value while basic food crops have been static in many countries — while food available per capita has decreased over the past two decades. Although the data in the summary report and in Table 1 are ambiguous to some degree — groundnuts is both a subsistence and an export crop — we can see that the total area dedicated to these specialty crops is small in proportion to the total cropped area. Specialty crops are predominantly produced under non-LRA conditions, although there are specific crops in some regions which appear to be entirely LRA crops, eg. coffee in the humid regions and cotton in the highlands. These export crops are important to agricultural trade and to foreign exchange — their importance will continue. With respect to relative importance, it must be recognized that some of the best lands are dedicated to export crops, and some of this area could better be planted to food crops for local

consumption if there is a comparative advantage to produce them closer to consumers and assure family food supplies. It is critical to consider a development strategy focused on those crops which produce basic subsistence, and which become each country's first line of defense against hunger, and to balance this need with a continuing demand for export earnings.

11. Production of Basic Food Crops. Total production of food crops and specialty crops is summarized in Table 2 by crop group and by agroecological zone; this information supplements the global summary by crop in the USDA Table 4. Production figures are similar to those for area under cultivation. Cereal grains are the most important crops, and thus the primary sources of energy and protein, in the arid, semi-arid, seasonally humid, and highland regions of SSA. Grain legumes contribute substantially to the production, especially in the arid and semi-arid zones, and starchy root crops are important sources of energy in the humid zones — especially the continuously humid zone of the sample countries.

12. Importance of LRA Food Production. From the tables and the summary report, it is clear that LRA is focused on production of food crops for local sale and consumption — essentially all of the yams, cocoyams, and cassava are produced by LRA farmers. In the eight countries, the LRA sector also accounted for more than half of the millet, groundnut, and rice produced — recognizing that groundnut is both an export and a subsistence crop. From the country reports, it is clear that area planted to export

crops has increased -- in Senegal cotton area has moved from about 1,000 to more than 30,000 hectares since 1961, while area in groundnuts, millet, sorghum, and rice has stayed about the same. Another indication of importance of LRA contributions to food production comes from the Nigeria country report. In a series of tables, the area, production, and productivity of sole cropping versus mixed cropping is summarized. Since most mixed cropping is practiced by LRA farmers, it is fairly accurate to predict that these mixed crops are primarily grown without purchased inputs and would classify as "LRA" according to our working definition.

13. Productivity of LRA. Levels of production per hectare for each major crop and crop group, as well as for each agroecological region, are summarized in Table 3. Using the totals for all countries in the sample, productivity in LRA and non-LRA sectors (shown as "HRA") were calculated from the USDA Table 3. HRA or "high resource agriculture" is not an accurate term, since a farmer who uses any single purchased input and thus does not qualify for LRA status would be called HRA in this table -- yet the contrasts are clear for some crops. The calculations are, using millet in ASA as an example,

LRA productivity (kg/ha) = (LRA production)/(LRA area)

HRA productivity (kg/ha) =

(Total Production - LRA Production) / (Total Area - LRA Area)

These calculations give a reasonable estimate of productivity under the two systems, with some anomalies in the results. For example, productivity of some crops in some zones appears to be higher under LRA conditions. This is possible, if crops are cultivated more intensively on a small area using internal resources by LRA farmers, and cultivated more extensively on larger areas by farmers with a greater resource base. Or perhaps the LRA farmers cultivate more productive land in some countries with these crops. More likely, the anomalies are due to inaccuracies in the data, and we must interpret the results with caution. Percent area and percent production of the major crop groups in low-resource agriculture are summarized by agroecological zone in Table 4. The proportion of production from the LRA sector generally is less than the proportion of area cultivated, illustrating in another way the lower yields under LRA conditions. The exception is starchy root crops, where the two numbers are roughly equivalent — these are primarily LRA and small farmer crops.

14. Specific Crop Results. Levels of productivity under low resource conditions vary widely with crop and country. Comparisons listed here depend on the quality of data in the USDA report, and their accuracy is subject to some scrutiny. Cotton yields under LRA conditions in the ASA are about 205 kg/ha, while non-LRA yields in the same zone are calculated to be about 2276 kg/ha. Thus, yields under LRA conditions are only 9% as high as those under higher input conditions. Estimated from the graphs in the USDA report, yields of groundnut across the three lowland

zones where they are produced are about 680 kg/ha under LRA conditions and 1180 kg/ha under non-LRA conditions. LRA productivity of groundnuts is about 58% of non-LRA yields. For sorghum, the respective yields are 635 kg/ha in LRA and 827 kg/ha for non-LRA; low-resource productivity is about 77% of the yield under improved resource conditions. Millet, primarily a crop of the LRA farmers, has yields of 622 and 683 kg/ha under the two contrasting conditions; LRA yields are 91% of the non-LRA yields. The differences among these four crops could reflect their importance to governments and to research specialists — and to those who finance research and development. Cotton is primarily a low-value export crop, and groundnuts are both an export and a subsistence crop. Sorghum is primarily a basic food crop, but there are areas where the crop is grown commercially with added inputs, as in the Gezira irrigation project of Sudan. Millet is almost exclusively a subsistence crop, with 70 to 80% of the area and production coming from LRA. Yields are little improved, according to the data, by added inputs. Thus, less research on the subsistence grain crops could have resulted in little appropriate technology for these important commodities. Or perhaps it reflects where these crops are grown — extensively cultivated on the most marginal lands. In these areas, production constraints are severe, and we would expect less response to technology — plants will not respond to added fertilizer if there is a severe water constraint. Even the country reports do not offer much help in determining cause and effect, or providing insight on why LRA yields are low or how to improve them.

Diversity of Production Constraints

15. Diversity of Constraints: the Maize Model. To illustrate the range of diversity which exists among countries, among zones within countries, and between LRA and non-LRA sectors, the maize crop was chosen as a model for further calculations. There is maize reported in seven of the eight sample countries, located in one to three of the agroclimatic zones in each country. Highest yields are found in the highlands of Kenya, the seasonally humid region of Zimbabwe, and the arid/semi-arid region of Mali. Lowest yields are found in the seasonally humid regions of Zaire and Mali, the continuously humid part of Zaire, and all parts of Nigeria. All or the majority of the maize is grown under low-resource conditions in Senegal, Mail, Nigeria, Zaire, and Malawi; only one third of the maize in Kenya and one quarter in Zimbabwe is grown under LRA conditions. Even this varies with region in each country. Reported yields are similar between LRA and non-LRA sectors in four countries — we might question these data sources. In Kenya and Zimbabwe, the yields in non-LRA conditions are as much as twice those in LRA, while in Malawi theF report indicates yields over four times as high in non-LRA conditions. There is a definite influence of the highly successful maize breeding programs in both Kenya and Zimbabwe — and these programs have been the source of improved hybrids for other highland zones in other countries of the region. Yields

undoubtedly are low in many of the lowland regions of SSA due to the common practice of intercropping maize with a number of other species — as many as 15 crops are commonly found in single fields in Nigeria — or lack of varieties/hybrids well adapted to this climate and cropping system.

16. Strategies Suggested from the Maize Model. How do these constraints differ among climatic zones, and how does this influence research priorities? There is no doubt that different research and development strategies need to be employed in the different countries, regions, and sectors of agriculture. The success of maize in Kenya and Zimbabwe has been due in part to along-term emphasis on maize breeding, improved cultural management of the crop, and wide use of hybrids by farmers who use high technology. These hybrids recently have been made available with some success to LRA farmers. In Kenya, this happened first by laborers on large farms taking seed back to plant their own fields. Later a conscious campaign was launched by a commercial seed firm, the Kitale Seed Company, to market hybrids with small farmers. Seed was packaged in 5 kg bags instead of the common 50 kg bags used for large farms. Posters were used in many villages to promote timely land preparation, planting, weeding, fertilizing, and pest control. Although some of the emphasis was on purchased inputs, much of the focus was on improving agronomic practices using timely investment of labor and management skills. Seed sales and yields climbed in the highlands where this program was successful in Kenya.

17. **Potentials and Limitations of Plant Breeding.** Of the many technologies proposed to solve food production problems, none has been as successful in some areas as crop improvement through breeding. At the same time, few technologies have been so over-rated as the unique solution to increasing production — without the need for a comprehensive approach which looks at other constraints and potentials of the production environment. Improving the genetic potentials of crops to produce higher yields is a key element in designing a more productive system. Plants with greater disease and insect resistance, better fertilizer or nutrient use efficiency, improved tolerance to stress conditions, or broader adaptation to a range of conditions can significantly improve the potential for increased yields — and this is available to the farmer at a very low cost compared to that of other inputs. Yet plants do not grow without water, cannot out-compete weeds in most circumstances, and need adequate fertility to achieve adequate yields — these things do not automatically happen when a new hybrid or variety is introduced. On the other hand, use of a new genetic strain does not absolutely require the use of new or additional expensive fossil fuel based inputs in order to be successful, as implied by many critics of the green revolution. In fact, most hybrids will perform better than traditional varieties under most production limiting circumstances — if the hybrids or improved varieties are properly selected and tested in those environments. Genetic engineering/biotechnology provides new dimensions to plant improvement, and the emphasis on changing the plant to fit the

environment is gaining popularity with plant breeders — as opposed to our earlier notion that the environment had to be controlled and changed to fit the available plant varieties.

18. Diversity of Solutions. Plant breeding has been seen as the cornerstone of new technology in many situations — improve the genetic potential of each crop and then discover what additional inputs are needed to reach maximum yields. Although improved genetic potential is necessarily a part of most yield-improving strategies, it is not always the most important component nor a quick and easy solution. Plant breeding is a long and complicated process, often requiring 5 to 10 years for a new hybrid or variety to reach the farmer after the first cross is made. There are many situations where agronomic improvement could yield much quicker returns to research and production investment than a genetic solution. If key limiting constraints can be identified, such as an obvious fertility or water deficit, certain field practices to produce more nitrogen or recycle more phosphorus, or to trap and store more rainfall, could lead to rapid crop yield improvements. In some situations, a change in crop species could lead to either higher yields or greater stability in the system. It is not by accident that millets are grown in the most arid regions, and sorghum is grown where rains are more dependable. Where there is ample rain or potential for irrigation, maize is a common choice for the predominant cereal. Choice of the best crop for a given region and set of constraints could improve yields or reduce risk of crop failure.

19. Need for Multiple Strategies. Faced with the diversity of constraints which face LRA farmers in SSA, it is important to focus on a range of research and development strategies to increase food production and income. As illustrated by the USDA data, productivity levels of specific crops differ by country and by climatic zone. Limitations to crop productivity also vary with crop and with region, and include climatic, soil, labor, capital, and information constraints. In general, the "packages of technology" envisioned in the green revolution do not take into account this diversity of potentials and constraints. They have assumed the availability of capital and of inputs which can dominate the production environment, to some extent, to improve productivity by changing the field environment to approximate the ideal conditions needed for maximum crop growth and yield. Needless to say, this is a costly and inappropriate strategy in much of SSA. A range of alternative strategies is needed which takes into account not only the physical and climatic limitations to crop production, but also the economic and social conditions and goals of the farm family and available labor. A number of such alternatives are discussed below.

20. Dynamic Nature of Crops and Systems. Although we view cropping systems and their components at one point in time, and they often appear to be well established and "traditional" in a given region, in fact systems are evolving all the time. One need only examine the important crops in the USDA report to find evidence of large scale introductions of new species into the cropping systems of SSA. Maize is native to the Americas, rice

to Southeast Asia. Groundnuts and beans likewise came from the Americas, soybeans from China, and cassava and coffee from the Amazon basin. These initial introductions occurred centuries or decades ago, but the new crops have replaced or supplemented onesF which evolved on the continent. Maize replaced sorghum as the predominant food crop in Kenya, rice partially replaced sorghum and millets in parts of West Africa. Sorghum in fact came from the highlands of Ethiopia much earlier, supplementing whatever crops were grown for subsistence before that time. Beans are popular in the highlands and central regions, where cowpeas (origin in Nigeria) certainly were present much earlier. The important point is that crops and systems are evolving, with farmers taking a look at new species and practices every year — those which are successful and meet some perceived food or other need are preserved and multiplied. It is into this dynamic mileau of agricultural components and systems that we need to provide potential new ideas, altered or different crops, and alternative technologies which can make a difference. Alley cropping, water trapping and conserving technologies, and more adapted varieties are all examples of appropriate technologies.

Resource-Efficient Technologies

21. Conceptual Basis: Internal versus External Resources. A recent approach to design of technology for LRA has described resources as internal and external. Those which are internal to the farm and immediate environment include sunlight, rain, nitrogen fixed from the atmosphere, nutrients cycled up from

lower soil strata, and farmer management skills. External resources include purchased fertilizers, pesticides, irrigation water which requires fuel for pumping, and outside capital and management expertise. LRA ischaracterized by a reliance on internal resources — most of which are renewable. Much of our development effort has been geared to domination of the farm environment with external resources — many of them costly and dependent on non-renewable fossil fuel energy. If a strategy can maximize the use of internal resources, with a minimum of necessary purchased inputs, it is more likely to be adopted by a farmer who practices LRA, and who is vitally concerned about costs and risks inherent in most new technology. In any sector of agriculture, a shift in emphasis from external toward internal resources will reduce production costs, can reduce risk if done properly, and may increase the sustainability of production systems — since there is a greater emphasis on use of renewable resources.

22. Alternatives Ways to Improve Soil Fertility. Soil nutrients frequently are limiting in SSA, perhaps in more than 80% of soils, due to the long time of cultivation and the recent reduction of time in fallow due to high population density and immediate need for food. Chemical fertilizers are expensive and often not available in areas with limited accessibility by road or other means of transport. An alternative to chemical nitrogen is reliance on bush or improved fallow or rotation with legumes. This and other methods which depend on internal resources were described by Vlek et al. (1986): biological nitrogen fixation,

manures and other indigenous nutrient sources, and microbial organisms to enhance nutrient availability. Up to 250 kg/ha of nitrogen was provided by legumes in experiments in Brazil, enough to produce a maize crop of 7000 kg/ha, but only after lime and phosphates were added. Cultivation schemes which reduce erosion and water runoff prevent loss of nutrients, and this is one of the least expensive sources of fertility available — reducing or eliminating losses of what is already in place. Depending on labor availability, new systems using alley cropping or mixtures of perennial leguminous and other trees with annual crops also hold promise for restoring or preserving fertility needed for crop growth. Nutrient cycling from lower soil strata by mixtures of deep rooted crops with shallow rooted annuals provides another source of inexpensive fertility, depending on nature of the subsoil and how much of the crop is harvested. All such schemes depend on internal resources, and all are renewable sources of crop nutrients. A realistic and appropriate technology has not been worked out and widely tested to make major use of these sources of fertility in agricultural development — although one could argue that farmers are practicing most of these methods to some degree already. Some soil fertility specialists feel that increased use of internal resources — improved nutrient cycling, more legumes in systems, greater cropping intensity — will not be sufficient to solve the soil fertility challenge. There is a need for concentrated research, validation, and demonstration of techniques which will work consistently, and which can be easily demonstrated and taught to farmers.

23. Control of Insects and Pathogens. Crop pests cause dramatic losses in much of the developing world — some estimates of losses reach 40% or more. Insect and disease problems are readily apparent to farmers, and the chemical control approaches can produce spectacular results when properly applied. Too often, however, products are diluted when they are sold to the farmer or otherwise are found ineffective because of inappropriate rates, timing, or specificity to an insect or pathogen. Chemical control methods require a certain level of understanding and training on the part of farmers for consistent and successful results. Another dimension of chemical pest control is use of containers after chemicals are exhausted — there are untold numbers of cases where people suffered debilitating or fatal injuries from injesting chemical residues after food was stored or transported in used chemical containers. There are other control alternatives which can be effective for most insect and pathogen problems. Crop rotation physically removes a succeeding crop from a major source of problems — the crop residues which contain larvae, eggs, spores, or other infectuous materials which serve as sources for infection or infestation of the next crop. These pests may not survive until the same crop is planted again. Choice of hybrids or varieties resistant or tolerant to major pests can be an inexpensive solution for the LRA farmer — in fact the definition might be changed so that improved genetic material could be included in a system which is still "LRA" in other respects. Changing from a susceptible crop to one which is tolerant is another approach.

Intercropping two or more species generally results in less losses to insects and pathogens, and even when one component is attacked the others will compensate with higher yields. These are all options which have been proven successful in specific sites — their wider testing and demonstration is needed in SSA.

24. Weed Control Alternatives. Herbicides have been used in green revolution technology packages, but still are the least accepted of pest control measures among small and limited-resource farmers. Weed populations are ubiquitous, and frequently farmers do not realize the effects of unwanted species on crop yields. Further, weeds are harvested for forage in many areas, tiding the animals over until harvest of stover from a later grain crop. In Southern Morocco, wheat and barley fields are regularly gleaned for green weed material to feed sheep, goats, and cattle during the early growing season, and until straw from the cereals is available. Crop rotations and timely cultivation — either by hand or with machinery -- can reduce weed populations during the critical first 4 to 6 weeks of the crop cycle; neither requires use of expensive and poorly understood chemical herbicides. Careful roguing of weeds from the crop during the rest of the growth cycle, either for animal feed or for mulch in the crop, can reduce weed reproduction and minimize problems in future seasons. Animals can selectively graze weeds from certain crops — cattle eat the weeds from between plants of a lemon grass crop, for example. More research is needed on weed control in low-resource systems, and education

of farmers is a part of raising awareness about the severity of losses to weeds.

25. Other Resource-Efficient Practices. Genetic improvement of crops and the release of hybrids and varieties with greater disease and insect tolerance is a definite boon to farmers with limited resources. Vegetative planting material free of virus diseases of crops such as cassava and potato is becoming more available due to the active work of the international centers in improving and cleaning up these species. Water harvesting and storage techniques have been tested, and are becoming a part of resource-efficient systems in arid and semi-arid regions. These are discussed in another OTA paper (Matlock, 1986). Tillage alternatives using large equipment still are beyond the reach of most LRA farmers. Reduced tillage does hold promise for saving scarce water from rain and for reducing weed problems if used in conjunction with other weed control measures. Intercropping systems provide some control of weeds and insects, and generally are considered to be more efficient is use of total resources when compared to monoculture — especially at low levels of resource use. There are examples of the applications of all these technologies, but often they are poorly documented or site specific in their utility. More information is needed through research on these alternatives in order to fully realize their potentials for improving LRA.

26. Application of Alternative Technologies in LRA and HRA. Most of the technologies listed and discussed will find or have

found application in both LRA and non-LRA situations in Africa. Where a practice has a clear economic or productivity advantage, this will be readily adopted — perhaps first by those more advanced farmers who have access to information and other inputs. Control of fall armyworm in maize through crop rotation, or planting streak mosaic-free stocks of cassava will undoubtedly be adopted first by those with access to the information and germplasm. Other practices which are more labor- and system-specific such as intercropping or other complex planting systems may be small farm specific, and thus maintained or adopted more readily by farmers with limited resources. Thus, the development of more resource-efficient technologies will benefit both LRA and other farmers, and often will be adopted first by the latter. As discussed below, there are important food production and environmental implications of the adoption of these practices by both groups. A substantial move in this direction by specialists involved in research and development and agricultural sector planners could provide positive benefits in food availability and rural incomes, especially for current LRA farmers.

Table of Promising Technologies

27. Promising Technologies. Based on the background papers and the workshop discussions, a number of specific cropping practices are identified as meeting the criteria discussed above. A list of major technologies which are appropriate for LRA farmers is

presented in Table 5, along with constraints for each technology, where each change can be implemented and by whom, and what the role of U.S. development assistance could be to help promote the change. In addition to specific technologies, there are some conceptual changes in research, training, and extension which are vital to the new orientation toward successful low-resource agriculture. These are organized under nine general goals for development.

Trade-Offs with Low-Resource Technologies

28. Available Technologies. Most technologies currently recommended by research and extension services, and those that are actively promoted by commercial industry, build on the premise of agricultural development based on monoculture with purchased inputs and a "high-tech" approach to increasing productivity. There are some management ideas which do not involve additional external inputs, and these may or may not be well suited to current farmer systems. Traditional cropping systems and management methods often have been seen by professionals in agriculture as backward, unproductive, and unresponsive to the introduction of new components of technology. Needless to say, people in development are questioning this assessment. The traditional methods have allowed farmers and families to survive for centuries, and there has been a long process of "natural selection" leading up to what we see today. An appropriate focus for next generation technologies is the blending of traditional wisdom and cropping systems with certain

components of improved technology. The right mix can lead to increased productivity and reduced risk for the farmer. A new variety or hybrid might be the key to pest resistance or more efficient use of limited available rainfall — and this new genetic combination could be introduced into an existing system. A systematic search is needed for those traditional technologies which are successful, and for those new components which can solve farmer-perceived constraints in the traditional systems.

29. Short-Term Implications. Promotion of some low- or limited-resource technologies can have immediate and significant effects on crop production. The new hybrid/variety introduction is one example, and water capture methods which can make limited rainfall available to crops is another. There is a need for many more appropriate LRA technologies to be developed, tested, and validated on farms. These approaches are more complex than technologies which provide a dominance over the physical and biotic environment, and which produce dramatic visible effects — killing a serious weed or insect species with chemicals or solving an obvious nitrogen deficiency with synthetic fertilizerF are examples. Management systems which achieve the same goal may take more education of farmers, careful timing of implementation, and site-specific recommendations. Thus, the short-term results may be less spectacular than what could be achieved by introduction of carefully targeted pesticide, fertilizer, or other "high-tech" input. This is a part of the challenge of appropriate technology for LRA.

30. Long-Term Implications. The longer range projections of these LRA technologies are more promising. As more examples and successful experiences become available, and these are tested and demonstrated to farmers, there will be a greater storehouse of technologies "on the shelf" for each area. In general, these LRA approaches are more sustainable in terms of resource use — they depend to a much greater degree on resources which are renewable and internal to the farm. There is less reliance on national and local infrastructure for purchased inputs, and less need for credit or other purchasing or bartering power for the farmer to access the technologies. The long-term implication for national governments and their economies is positive — less outflow of scarce foreign exchange for petroleum-based inputs can help the balance of payments. There can be a significant development of the agricultural sector without the large inputs of fuels and chemicals which are generally thought to be necessary. But this is only possible if the alternatives are recognized and actively promoted by national planners as well as research and extension personnel. The "who can implement" column in Table 5 lists many activities for national educational, research, and extension programs — these are vital to success.

31. Environmental Consequences. Since these resource-efficient or LRA-directed technologies are less dependent on chemical fertilizers, pesticides, and other fossil-fuel derived inputs, there is less effect of their implementation on the environment. Most involve the manipulation and efficient use of internal inputs already found on the farm and the immediate environment,

and their effects both within the boundaries of the farm and elsewhere are much more benign. There is a drastic potential reduction of pesticides in groundwater and runoff water, and less chance of residues in foods. Finally, there is a minimal chance for inadvertent poisoning of people from the use of pesticide containers — when these are not used or are only a small part of the new technologies.

Implications of Ignoring LRA Technologies

32. Potentials for Increased Food Production. There is much debate in technical circles about the potentials of increased production without concentrated use of fertilizers and pesticides. Some argue that production would drop drastically, and that there are no alternative solutions without what we are calling "high-tech" packages and the credit needed to bring them to the farm. Experience in the U.S. and elsewhere is showing that many of the "low-tech" solutions outlined do in fact have great potential for increasing yields where they currently are low, and to maintaining productivity while reducing or eliminating many of the inputs used in today's modern systems. Where improved technology has not reached farmers -- certainly the case in LRA farming systems in Africa — there is great potential for offering alternatives to current systems. Even better is the integration of key critical elements or inputs into current cropping systems. This causes less disruption of the social and economic situation, and holds promise to incrementally help to push up yields and income for farm families. As more

experience is built up from development efforts with appropriate technology, there will be a better indication of how much yields can be increased in this alternative approach.

33. Availability of Needed Production Inputs. Since most of the production technologies outlined depend on internal resources on the farm, there is little need for import of production inputs from outside the country, region, or farm. The most needed input is information, and the experience which is gained by working with successful LRA farmers can be transferred to others with success. These, in a way, are "information-intensive" cropping systems, and information and management skills can to some degree substitute for purchased inputs.

34. Economic Implications. The economic consequences of successful introduction of technologies dependent on internal resources are obvious -- increases in productivity and productiono without substantial increases in input costs are going to be profitable. Broader economic implications to national governments are obvious -- if these systems can reduce the need for imported production inputs and fossil fuels. There are also important implications of ignoring some appropriate components of the "high-tech" package -- use of an improved hybrid with drought tolerance or insect resistance can be an extremely cost-effective approach to improving yields.

35. Social Implications. There is less chance of serious disruption of local social and political structures if there is not a drastic change in the structure of farming, land ownership,

and balance of power in a community. The technologies outlined are relatively scale neutral, in that the resources needed to implement them are available to all who have access to land. There is certainly less economic bias to the potential implementation of these approaches, relative to technologies and systems based on massive use of purchased inputs. Successful use of appropriate LRA technologies as outlined would have equitable consequences in the rural sector, compared to other "high-tech" alternatives.

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Table 1. Area in basic food crops and in specialty crops grown under "low resource" (LRA) conditions and total area in same crops (1,000 ha).

	Cereal Grains			Grain Legumes			Starchy Roots			Specialty Crops		
Region	Crop	LRA	Total	Crop	LRA	Total	Crop	LRA	Total	Crop	LRA	Total
Arid, Semi-Arid	Millet	5184	6821	Groundnut	1188	2176				Cotton	293	1073
	Sorghum	2985	5003	Soya	0	8				Sisal	0	62
	Wheat	0	172							Coffee	0	20
	Rice	59	117									
	Maize	407	1177									
	Sesame	244	550									
Total		8879	13840		1188	2184		0	0		293	1155
Seasonally Humid	Maize	1591	2874	Groundnut	620	839	Cassava	812	888	Coffee	17	17
	Rice	349	753	Beans	45	116	Yams	419	419	Cotton	26	201
	Millet	407	594				Cocoyams	59	59	Tobacco	0	116
	Sorghum	2134	3510									
	Sesame	69	69									
Total		4550	7800		665	955		1290	1366		43	334
Contin. Humid	Maize	669	959	Groundnut	305	339	Cassava	2199	2387	Coffee	192	192
	Rice	597	663	Beans	122	136	Yams	977	977			
							Cocoyams	238	238			
Total		1266	1622		427	475		3414	3602		192	192
Highlands	Wheat	0	103							Sisal	0	35
	Rice	0	8							Tea	31	80
	Maize	400	1071							Coffee	136	136
	Millet	62	62							Cotton	84	84
										Pineapple	0	5
										Sugarcane	20	41
Total		462	1244		0	0		0	0		271	381
Total (8 country)		15157	24506		2280	3614		4704	4968		799	2062

Table 2. Production of basic food crops and specialty crops grown under "low resource"(LRA) conditions and total production of same crops (1,000 tons).

	Cereal Grains			Grain Legumes			Starchy Roots			Specialty Crops		
Region	Crop	LRA	Total	Crop	LRA	Total	Crop	LRA	Total	Crop	LRA	Total
Arid, Semi-Arid	Millet	3189	4289	Groundnut	920	1882				Cotton	60	1835
	Sorghum	2047	3326	Soya	0	11				Sisal	0	34
	Wheat	0	235							Coffee	0	11
	Rice	86	194									
	Maize	439	1241									
	Sesame	72	117									
Total		5833	9402		920	1893		0	0		60	1880
Seasonally Humid	Maize	1299	3468	Groundnut	393	658	Cassava	6243	6806	Coffee	6	7
	Rice	636	956	Beans	22	103	Yams	4995	4995	Cotton	5	208
	Millet	259	385				Cocoyams	333	333	Tobacco	0	147
	Sorghum	1314	2238							Palmoil	22	22
	Sesame	20	20									
Total		3528	7067		415	761		11571	12134		33	384
Contin. Humid	Maize	622	891	Groundnut	213	237	Cassava	17059	18435	Coffee	82	82
	Rice	984	1093	Beans	61	68	Yams	11655	11655	Rubber	50	86
							Cocoyams	1332	1332	Palmoil	516	663
Total		1606	1984		274	305		30046	31422		648	831
Highlands	Wheat	0	222							Sisal	0	16
	Rice	0	39							Tea	40	126
	Maize	450	1998							Coffee	84	84
	Millet	90	90							Cotton	12	12
										Pineapple	0	155
										Sugarcane	1550	3107
Total		540	2349		0	0		0	0		1686	3500
Total (8 country)		11507	20802		1609	2959		41617	43556		2427	6595

Table 3. Productivity of basic food crops and specialty crops grown under "low resource" (LRA) and "high resource" (HRA) conditions (kg/ha).

	Cereal Grains			Grain Legumes			Starchy Roots			Specialty Crops		
Region	Crop	LRA	HRA	Crop	LRA	HRA	Crop	LRA	HRA	Crop	LRA	HRA
Arid, Semi-Arid	Millet	615	672	Groundnut	774	974				Cotton	205	2276
	Sorghum	686	634	Soya	-	1375				Sisal	-	548
	Wheat	-	1366							Coffee	-	550
	Rice	1458	1862									
	Maize	1079	1042									
	Sesame	295	147									
Average*		657	719		774	977		-	-		-	-
Seasonally Humid	Maize	816	1691	Groundnut	634	1210	Cassava	7688	7408	Coffee	353	-
	Rice	1822	792	Beans	489	1141	Yams	11921	-	Cotton	192	1160
	Millet	636	674				Cocoyams	5644	-	Tobacco		1267
	Sorghum	616	672									
	Sesame	290	-									
Average*		775	1089		624	1193		8970	7408		-	-
Contin. Humid	Maize	930	928	Groundnut	698	706	Cassava	7758	7319	Coffee	427	-
	Rice	1648	1652	Beans	500	500	Yams	11929	-			
							Cocoyams	5597	-			
Average*		1269	1062		642	646		8801	7319		-	-
Highlands	Wheat	-	2155							Sisal	-	457
	Rice	-	4875							Tea	1290	1755
	Maize	1125	2307							Coffee	631	-
	Millet	1452	-							Cotton	143	-
Average*		1169	2313		-	-		-	-		-	-
Overall Average*		759	994		700	1010		8847	7345		-	-

*Average based on total hectares of crops and total production in each region and in 8 countries

Table 4. Percent area and production of major crop groups in low resource (LRA) conditions. *

	Cereal Grains		Grain Legumes		Starchy Roots		Specialty Crops	
	Area	Prod	Area	Prod	Area	Prod	Area	Prod
ASA	64	62	54	49	—	—	25	3
SHT	58	50	70	55	94	95	13	9
HCL	78	81	90	90	95	96	—	—
HIGH	37	23	—	—	—	—	71	48
TOTAL*	62	55	63	54	95	96	39	37

* Based on total figures by crop group.

Table 5. Description of major categories of promising technologies for low-resource agriculture in Africa.

Constraint	Needed Action	Where to Implement	Who Can Implement	U. S. Role
Goal A: Improve Soil Fertility				
Low Soil Nitrogen	Rotations, green manure crops, alley cropping with perennial legumes	Semi-arid, seasonally humid zones on stations and demonstration plots	National research programs and international centers	Focus training and development funds on alternatives.
Inadequate Phosphate	Promote use of low-cost, local phosphate sources	Arid, semi-arid zones with farmers	National research programs	Promote alternatives to chemical P
	Explore potentials of P cycling	Experiment stations	International research centers	Fund research in nutrient cycling
Goal B: Promote Improved Crop Protection				
Serious Weeds	Recognize weeds as production problems	Demonstration plots on farms, stations	Extension Service, schools	Support educational programs on weeds
	Seek alternative control practices	Research on experiment stations and farms	National program research teams	Provide expert assistance
Insects Cause Crop Losses	More rotations and intercrops to control	Research stations and demo, farms	Extension Service, schools	Provide background data, examples
	Tolerant varieties, hybrids, new species	Research stations, seed production farms	National plant breeders, IARC scientists	Support plant breeding and seed programs
Plant Diseases	Introduce resistant hybrids/varieties, crop rotation	Experiment stations and farmer demos.	Extension Service and research specialists	Technical support

Table 5. Description of major categories of promising technologies for low-resource agriculture in Africa.

Constraint	Needed Action	Where to Implement	Who Can Implement	U. S. Role
Goal C: Increase Water Available to Crops				
Inadequate Rainfall, Water Loss	Water and soil conserving practices	Arid and semi-arid zones, on station and farms	National research and extension programs	Research and extension support
Inefficient Water Use	Develop efficient varieties	International centers and national research programs	Plant breeders on research stations	Technical support
Goal D: Introduce Low-Cost Appropriate Tillage Options				
Poor Seedbed and weed control	Small scale or cooperative equipment	Cooperative groups, local level	Government incentives, extension support	Help develop appropriate technology
Goal E: Develop and Introduce Improved Integrated Farming Systems				
Technology Developed for single crops	Farming systems approach to research and extension	Collaborating farmer sites	National research and extension programs	Methodology and training
Goal F: Promote Appropriate Technology Through Teaching and Training Programs				
Focus on Hich Tech Solutions	Orientation toward alternative technologies	Agricultural colleges, technical schools, extension training	National universities, ministries of education and agriculture	Training and teaching methods
Goal G: Upgrade and Re-orient University and High School Programs				
Absence of Well-Trained Faculty and Staff	Massive education and training of teachers and technicians	Training preferable in African institutions	Ministries of education and agriculture	Financial and Technical support

Table 5. Description of major categories of promising technologies for low-resource agriculture in Africa

Constraint	Needed Action	Where to Implement	Who Can Implement	U. S. Role
Goal H: Conceptual Orientation Toward Basic Food Production and Self-Sufficiency				
Concentration on High Tech and Export Crops	Change focus toward basic food crops	National planning level and on farms	Ministries of agriculture and national planners	Technical support, export policies and import policies
Goal I: Recognize the Diversity of Constraints and Solutions Needed for LRA				
Green Revolution Solutions & Technical Package Mentality	Multiple strategies and system-based solutions	Research stations and on-farm locations	National research and extension programs, national planners	Re-orient development projects, focus on farming systems approach

Potential of Low-Resource Agriculture in Africa
OTA Technical Paper Series

Commentary on ERS/USDA Survey

POTENTIAL OF LOW-RESOURCE AGRICULTURE IN AFRICAN DEVELOPMENT

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POTENTIAL OF LOW-RESOURCE AGRICULTURE IN AFRICAN DEVELOPMENT

Charles A. Francis

(Key elements for discussion, Sept. 29-30. 1986)

Executive Summary

1. Countries and Data Sources: The USDA document, "The Role of Low-Resource Agriculture in Africa: Overview and Summary" by B. D'Silva and A. Dommen, provides a valuable summary of the apparent extent of low-resource agriculture (LRA) in eight countries on the continent. Data are taken from secondary sources, including national statistical services and various ministries, FAO, and other reports. These eight countries do contain from 27 to 69 percent of the area dedicated to eleven specific crops, and from 29 to 78 percent of their total production. Thus, about half of the total production of these commodities is represented by the sample countries.

2. Agroclimatic Regions and Crop Production: For each commodity, the hectares and production in each of four agroclimatic zones are presented — arid, semi-arid zone; seasonally humid zone; continuously humid zone; and highland zone. This information would allow regionalizing crop-specific improvement projects or farming systems programs around certain combinations of crops and practices, and promote sharing of methods and technology across national borders within like climatic zones (not proposed in the report).

3. Extent of Low-Resource Agriculture: The authors define LRA as "any agricultural production process in which no modern inputs or modern production technology are utilized." It was necessary to massage available data to make this estimate in each country, but they have done a credible job of doing so. The percent of area and production of each of sixteen crops grown under low-resource conditions is calculated and presented in convenient histograms. LRA production ranges from zero in wheat and tobacco to near 100 percent in yam, cocoyam, and cassava. This information is important for the design of new technology and its testing with farmers.

4. Country Supplements to Overview Report: Perhaps the most valuable part of the report is the group of eight country-specific reports, with detailed tables and data from a range of sources. Any reduction of data implies a loss of information -- given the location and crop specificity of production constraints and of potential solutions to increase production and incomes, these country reports provide a rich background of data on each region and each crop within the country. They will be valuable to specialists planning projects for each country.

5. Applications of Overview and Summary Data: The report makes no attempt to move beyond these data to suggest strategies for development. Clearly, the information is useful, but it is only a

small first step to understanding the complexity of African agriculture and what interventions might be proposed to improve the nutritional and economic situation for people on the continent. A number of unresolved questions are presented in this evaluation of the USDA report.

USDA Data and Summary Report

6. Quality of Data: We must conclude that the information in the summary can be no better than the quality of the data which went into this analysis. As the authors point out, the information comes from a wide range of sources, from different ministries, from agencies which no doubt use a variety of methods to collect this data. There undoubtedly is variability in the quality and credibility of information. We must assume that this is the best information available to the ERS/USDA team. Unless someone in the OTA technical panel of experts has first hand information or other sources which vastly contradict what is in the report, we should operate on the assumption that this data represents the best available estimate of the actual situation -- subject to the constraints outlined by the authors. To debate otherwise would be non-productive. It should be noted that the scale on each of the figures in the summary report needs to be multiplied by 1,000 to be consistent with the tables of data -- the legend says "area and production in 1,000 ha and tons", but this in not clear in the figures. Although we can appreciate that this summary of data was done quickly to meet a deadline, to find a number of words spelled incorrectly is disconcerting -- one must conclude that 1) economists are poor spellers but good with numbers, or 2) the numbers, the analysis, and the summary may be no more accurate than the spelling.

7. Assumptions and Classification of LRA. Again, we could debate the decisions made on how to classify low-resource agriculture, but this would not help much in the evaluation of potential strategies to increase production and incomes from agriculture in Africa. Although an incorrect assumption could bias projects or decisions about technology to some small degree, this is a minor consideration. Much more valuable is a discussion of the perspective gained from an overview of the data, and how development should proceed with this new information.

8. Meeting the Goals of the OTA Assessment: Of the five stated goals of this assessment, only a part of the third goal is addressed in any meaningful way. This is to "determine the nature and magnitude of low-resource agriculture", and the report actually says little about the nature of LRA.

Extrapolation from the Report

9. Production of Export versus Local Food Crops. The concentration of LRA production on food crops for local sale and consumption is clear from the figures, with essentially all of the yams, cocoyams and cassava produced by LRA farmers. In the eight countries, the LRA

sector also accounted for more than half of the millet, groundnut, and rice produced (recognizing that groundnut is both an export and a subsistence crop). From the country reports, it is clear that area planted to export crops has increased -- in Senegal cotton area has moved from about 1,000 to more than 30,000 hectares since 1961, while area in groundnuts, millet, sorghum, and rice has stayed about the same. Although agriculture is a major source of foreign exchange, and this is vitally needed by governments in Africa, it is critical to focus on food crops which can help to satisfy the immediate demand in each country.

10. Productivity of LRA. The levels of productivity under low resource conditions vary widely with crop and with country. For example, extrapolating from the figures in the summary report, cotton yields under LRA are about 200 kg/ha, while non-LRA production is about 1200 kg/ha. LRA cotton productivity is 17% that of non-LRA farms. For groundnut, LRA yields are 680 kg/ha and non-LRA yields are 1180 kg/ha; LRA productivity is 58% of the non-LRA. And for sorghum the yields are 635 kg/ha for LRA and 827 kg/ha for non-LRA; low-resource productivity is 77% of the level found on farms using improved technology. There is no indication in the report of why this occurs -- conventional wisdom would tell us that technology increases yields. It could also be due to lack of response to technology in the subsistence food crops, or absence of an appropriate technology, for crops such as sorghum and millet; or perhaps these crops are grown most extensively on the most marginal lands -- where production constraints are severe and we would not expect a response to fertilizer, for example. Even the country reports do not offer much help in determining cause and effect, or providing insight on why LRA yields are low or how to improve them.

11. Diversity of Constraints: the Maize Model. To illustrate the range of diversity which exists among countries, among zones within countries, and between LRA and non-LRA sectors, the maize crop was chosen as a model for further calculations. There is maize reported in seven of the eight sample countries, located in one to three of the agroclimatic zones in each country. Highest yields are found in the highlands of Kenya, the seasonally humid region of Zimbabwe, and the arid/semi-arid region of Mali. Lowest yields are found in the seasonally humid regions of Zaire and Mali, the continuously humid part of Zaire, and all parts of Nigeria. All or the majority of the maize is grown under low-resource conditions in Senegal, Mali, Nigeria, Zaire, and Malawi; only one third of the maize in Kenya and one quarter in Zimbabwe is grown under LRA conditions. Even this varies with region in each country. Reported yields are similar between LRA and non-LRA sectors in four countries -- we might question these data sources. In Kenya and Zimbabwe the yields in non-LRA conditions are as much as twice those in LRA, while in Malawi the report indicates yields over four times as high in non-LRA conditions.

12. Strategies Suggested from the Maize Model. There is no doubt that different research and development strategies need to be employed in the different countries, regions, and sectors of agriculture. The success of maize in Kenya and Zimbabwe has been due in part to a

long-term emphasis on maize breeding and introduction of hybrids, especially to farmers who use high technology. These hybrids recently have been made available to LRA farmers with some success. Improved genetic materials cannot often move with success from one climatic zone to another, and breeding programs need to be carried out in each zone. Primary emphasis has been on breeding for monoculture, while most of the production in some countries comes from intercropping maize with legumes or other cereals. Perhaps maize is grown in some countries and regions where it would be better to promote use of sorghum or millet, to reduce risk of crop loss to drought and better use available moisture? This is an illustration of the complexity of decisions which must be faced with the improvement of yields and production of a single crop -- and each crop must be analyzed separately. More important is the improvement of a cropping system, building on the current cropping patterns and resource constraints of the farmer in each region -- we too often look at individual crop potentials and bring in technology which has worked somewhere else with that crop.

Critical Issues Not Addressed by the Report

13. Goals of the OTA Assessment. There are five objectives of this OTA study related to LRA:
-- provide Congress with options, and discuss U.S. policy dilemmas;
-- identify concepts and their applications to development of LRA;
-- determine nature, magnitude, limitations and potentials of LRA;
-- evaluate technologies, what has worked and what has not; and
-- discuss the context that affects the role of LRA in Africa.
Most of these are not addressed in the summary report, although there are supplementary tables and comments about them which can be useful in the country-specific reports. A number of unresolved questions need to be discussed by the expert panel, and perhaps more information is available to the panel from other background papers which could be provided by OTA.

14. Diversity of Agriculture and Solutions for LRA. The report does point out the range of crops and climates where they are grown, and this leads to the need for a range of solutions. We have approached agricultural development with a single crop mentality and a technical package extension orientation, while LRA farmers integrate a number of crops on the farm -- even intercropping in most fields -- and are seeking appropriate components of technology rather than a completely new, expensive, and risky system. There is a critical need for a multiplicity of solutions for different crops, crop/animal mixes, and farming systems under very different climatic, soil fertility, and economic constraints. Political, social, and educational variation further complicates this search for appropriate technology.

15. Challenges of Resource Distribution. There are large inequities in resource distribution and availability -- among economic groups, among regions and economic sectors within a country, among countries, and between Africa and other continents. Some of these are natural resource inequities -- fossil fuels, rainfall patterns, fertility of soils. Others are purely economic, due to inequities in distribution

of wealth. Most are exacerbated by political decisions within countries and in the international community. Without discussing these challenges in detail, it is important for the panel to consider what effects this current reality has on development of technology and its eventual use by LRA farmers. Dr. Vern Ruttan has stated that agriculture in many developing countries has not entered the fossil fuel age; in many LRA situations, farming is likely to never enter this age, given the scarcity of petroleum and the dependence on a global economy for its distribution.

16. National Government Priorities. Many of the references to development in Africa point to a need for policy reforms at the national level. Agricultural development has not been given priority, compared to other sectors, in most countries in Africa. When preference is given to industry, to construction in the capitol city, to a national airline and an international hotel, it is difficult for those in agriculture to compete for resources and interest from the national government. Within agriculture, greater emphasis on food crops for consumption within each country needs higher priority. And farmers need the incentives of fair prices for what they produce. These are but a few of the policy issues which should be addressed.

17. Internal versus External Resources. A recent approach to design of technology for LRA has described resources as internal and external. Those which are internal to the farm and immediate environment include sunlight, rain, nitrogen fixed from the atmosphere, nutrients cycled up from lower soil strata, and farmer management skills. External resources include purchased fertilizers, pesticides, irrigation water which requires fuel for pumping, and outside capital and management expertise. LRA is characterized by a reliance on internal resources -- most of which are renewable, while much of our development effort has been geared to domination of the farm environment with external resources -- many of them costly and dependent on non-renewable fossil fuel energy. If a strategy can maximize the use of internal resources, with a minimum of necessary purchased inputs, it is more likely to be adopted by a farmer who practices LRA, and who is vitally concerned about costs and risks in new technology. In any sector of agriculture, a shift in emphasis from external toward internal resources will reduce production costs, can reduce risk if done properly, and may increase the sustainability of production systems -- since there is a greater emphasis on use of renewable resources.

18. Building on Indigenous Technology. Development efforts have concentrated on new varieties and production packages which can be easily developed and tested on experiment stations and under the best of farming conditions. Often these have not reached the LRA sector of agriculture, and probably have not been appropriate to the farmers' objectives and constraints. An alternative approach is to work with the farmer to better understand the current system, to design together with the farmer some alternatives which could be tried, and to test these on station or on farm under real-world conditions. This is called Farming Systems Research and Extension methodology. The objective is to combine the best of indigenous technology and

conventional wisdom of the farmer with the advances which are possible through practical application of science.

19. Role of Women in African Agriculture. What "minority" group works two-thirds of the world's working hours, receives 10% of the world's income, and owns 1% of the world's property? We know that women are important in agriculture in most countries in Africa -- and that they make primary food and production decisions. Yet the institutions which are involved with agriculture -- planning, research, extension -- are most often organized and run by men, and rarely consider the unique nature of gender roles in current farming systems. Experts from other countries who work in development projects -- both women and men -- may not understand the difficulty of this situation, or be unwilling to consider challenging decision makers in the local culture with questions about potential change. Whatever the solution, this is a question which must be addressed, as it may be a critical part of development strategy for the future.

20. Ecological Soundness of Technology. Lastly we must address a series of questions about population and the environment and ecology of each African country. Although there is much written about the deterioration of soil fertility, the shortening of fallow cycles, the changes in rainfall patterns, and desertification -- there has been little effective progress in improving our focus within agricultural development projects. Regeneration of the soil as the primary production resource is vital to any strategy to improve agriculture in the long term. Use of resources internal to the system will have a better chance of sustaining production over decades and centuries, since this source of production factors is less subject to international monetary, political, or social changes.

21. Challenges of Population. To neglect the question of population would be to ignore one of the key factors in any development strategy. We must focus on people, both as a liability in terms of total numbers and demand for food, but also as a creative resource which holds great potential for solving production challenges through design of labor-intensive alternatives. Progress will be slow, and solutions complex. The hour is late, but now is the time to start.

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Contract Paper No. 3

DRAFT

The Role of Low-Resource Agriculture in Africa:

by

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Economic Research Service
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Congress of the United States
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OVERVIEW NOTES

THE PURPOSE OF THIS OVERVIEW IS TO EXPLAIN TO THE READER THE STEPS FOLLOWED IN ARRIVING AT OUR ESTIMATE OF LOW RESOURCE AGRICULTURE, AND TO EXPLAIN THE MATERIALS ATTACHED FOR THIS INITIAL REVIEW.

STEP 1. WE ATTEMPTED TO DETERMINE THE EXTENT TO WHICH OUR SAMPLE COUNTRIES REPRESENTED THE VARIOUS CROPS GROWN IN SUBSAHARAN AFRICA. TO DOTHIS, WE CALCULATED, BY CROP, THE PERCENT OF AREA AND PRODUCTION IN ALL OF SUBSAHARAN AFRICA THAT WAS REPRSENTED BY OUR SAMPLE COUNTRIES.

DATA FOR THESE CALCULATIONS CAME FROM THE USDA SUBSAHARAN DATA BASE AND WAS SUPPLEMENTED BY FAO DATA. RATHER THAN USE A SINGLE YEAR. WE USED AN AVERAGE FOR THE TIME PERIOD 1980-1985. THESE AVERAGES WERE THEN USED TO DERIVE THE PIE-CHARTS (WHICH ARE ATTACHED) WHICH SHOW THE PERCENT OF SUBSAHARAN AFRICA REPRESENTED BY OUR SAMPLE COUNTRIES. THESE PIE-CHARTS ARE BY CROP.

DATA USED TO CALCULATE THE PIE-CHARTS AND THE GRAPHS THEMSELEVES ARE ON LOTUS 1-2-3 FILES. THESE WILL BE TRANSMITTED. TOGETHER WITH HARD COPIES TO OTA (WE ARE TRYING TO ORGANIZE AND CLEAN UP ALL THE FILES AT PRESENT) TOGETHER WITH ALL THE COUNTRY FILES AND ASSOCIATED INFORMATION.

STEP II. A. OUR NEXT STEP WAS TO ATTEMPT TO DEVISE A METHODOLOGY TO DEFINE LRA AND TO DETERMINE THE EXTENT OF ITS PRACTICE BY CROP. AGROECOLOGICAL ZONE AND COUNTRY. HENCE IT INVOLVED DEVISISNG A METHOD TO DIFFERENTIATE BETWEEN LRA AND NON-LRA AT FOUR LEVELS.

B. THE INITIAL STEP IN THIS PROCESS WAS TO ALLOCATE THE AGROECOLOGICAL ZONES ACROSS COUNTRIES. THE USAID MAP WAS USED FOR THIS PURPOSE WITH SOME MINOR MODIFICATIONS (WHICH ARE DISCUSSED IN THE COUNTRY FILES).

AS COUNTRY CROP PRODUCTION DATA ARE NOT AVAILABLE BY AGROECOLOGICAL ZONE. WE DECIDED TO SUPERIMPOSE AN AGROECOLOGICAL ZONAL MAP OF EACH COUNTRY AND TO TRACE OUT THE APPROPRIATE ZONES ON A POLITICAL MAP. THE RATIONALE FOR THIS WAS THAT IN MOST COUNTRIES CROP PRODUCTION DATA ARE AVAILABLE BY STATE/POLITICAL REGION. FURTHERMORE. SPECIFIC AGRICULTURAL DEVELOPMENT PROJECTS WHICH ARE INITIATED BY COUNTRIES OR DONORS FOCUS ON STATES OR PARTS OF STATES. AS DATA WERE AVAILABLE ON SOME OF THESE PROJECTS WE WANTED TO ADOPT A BOTTOM-UP APPROACH AS WE THOUGHT THAT THIS WOULD NOT ONLY ASSIST IN DETERMINING SPECIFIC AREAS OF CROPPRODUCTION. BUT ALSO BE USEFUL IN DETERMINING THE EXISTENCE OF LRA.

C. WE THEN PROCEEDED TO COLLECT ALL RELEVANT INFORMATION FOR THE SAMPLE COUNTRIES. THESE INCLUDED DATA ON SPECIFIC AGRICULTURAL DEVELOPMENT PROJECTS. PUBLISHED AND UNPUBLISHED STATISTICS FROM THE SAMPLE COUNTRIES. RELEVANT DATA FROM USAID AND WORLD BANK PROJECTS. IN THE COURSE OF THIS EXERCISE WE AMASSED A CONSIDERABLE AMOUNT OF INFORMATION WHICH WE HAVE USED NOT ONLY TO DETERMINE AREA ALLOCATIONS ACROSS AGROECOLOGICAL ZONES. BUT ALSO DETERMINATION OF LRA AGRICULTURE. (ALL COUNTRY SPECIFIC INFORMATION ARE IN COUNTRY FILES).

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D. ONCE THESE DATA / INFORMATION WERE COLLECTED WE PROCEEDED TO DETERMINE THE EXTENT TO WHICH STATE/REGIONAL/PROJECT DATA EXISTED AND THE VARIABILITY IN QUALITY IN THE SAMPLE COUNTRIES. THE COUNTRY WHICH WAS THE EASIEST TO DEAL WITH WAS SUDAN. WHILE THE COUNTRY WHICH PROVED MOST DIFFICULT (INSPITE OF HAVING THE HIGHEST HEAP OF INFORMATION) WAS NIGERIA. THE REASON IS QUITE SIMPLE: WHILE AGRICULTURAL STATISTICS ARE COLLECTED IN NIGERIA. THE COMPLEXITY OF NIGERIAN AGRICULTURE. COMPLICATED WITH BUREAUCRATIC AND ADMINISTRATIVE PROBLEMS DOES NOT LEND TO COMPILATION OF ADEQUATE STATISTICS. WE DEAL IN DETAIL WITH EACH COUNTRY IN THE COUNTRY NOTES.

E. IN REVIEWING THE REGIONAL/STATE DATA FOR EACH COUNTRY. WE TRIED TO DETERMINE A COMMON YEAR FOR WHICH WE THOUGHT SHOULD HAVE BEEN AVAILABLE. THIS YEAR WAS 1982 AS THIS WAS BEFORE THE MOST RECENT DROUGHT AND WAS STILL RECENT ENOUGH TO PROVIDE A SNAP-SHOT VIEW OF LRA AGRICULTURE. HOWEVER. NOT ALL THE COUNTRIES HAD STATEWIDE DATA FOR 1982. FURTHERMORE. IN THE COUNTRY NOTES WE NOTE CHANGES THAT COULD HAVE TAKEN PLACE SINCE 1982 IN SELECTED COUNTRIES. IN CASES WHERE 1982 DATA WERE NOT AVAILABLE WE USED 1980 OR 1981 DATA. HENCE. WE WERE ABLE TO USE STATE AREA/PRODUCTION ESTIMATES FOR ALL COUNTRIES EXCEPT NIGERIA. IN NIGERIA, THE BEST ESTIMATES OF STATEWIDE DATA WERE AVAILABLE FOR 1974/75 (WHICH WE HAVE PRESENTED IN THE COUNTRY FILE). HOWEVER THERE HAVE BEEN MAJOR CHANGES IN CROP PRODUCTION OVER THE LAST 10 YEARS IN NIGERIA WITH INCREASED MAIZE PRODUCTIN TAKING PLACE IN NORTHERN NIGERIA. AND MOST OF THE CHEMICAL FERTILIZER BEING USED IN THE COUNTRY IS BEING USED IN THE NORTH. HENCE. FOR NIGERIA A TOP DOWN APPROACH WAS USED TO ALLOCATE NATIONAL PRODUCTION ESTIMATES BY AGROECOLOGICAL ZONE.

ONCE WE HAD ALLOCATED AN AREA AND PRODUCTION OF VARIOUS CROPS BY AGROECOLOGICAL ZONE AND COUNTRY. WE PROCEEDED TO OUR NEXT STEP.

STEP III. IN THIS STEP WE FOCUSSED ON THE DETERMINATION OF LOW RESOURCE AGRICULTURE. BY CROP. WITHIN ZONE AND WITHIN A COUNTRY.

WE ADOPTED A CRITERION WHICH WE THOUGHT COULD BE EASILY APPLIED AND BROAD IN ITS SCOPE. WE ALSO CONSIDERED THE AVAILABILITY OF DATA AND THE REVIEW OF COUNTRY LEVEL DATA. ON THIS BASIS WE DEFINED LOW RESOURCE AGRICULTURE AS "ANY AGRICULTURAL PRODUCTION PROCESS IN WHICH NO MODERN INPUTS (E.G. CHEMICAL FERTILIZER.PESTICIDE. HYBRID SEED) OR MODERN PRODUCTION TECHNOLOGY (E.G. TRACTORS OR DRIP IRRIGATION) IS UTILIZED". WHILE THIS WAS OUR BASIC DEFINITION. THE MANNER IN WHICH WE DETERMINED THE EXTENT OF LRA VARIED BY COUNTRY. ESPECIALLY DEPENDENT ON THE TYPE AND EXTENT OF DATA AVAILABLE. SOME COUNTRIES SPECIFICALLY COLLECT AND PUBLISH DATA ON MODERN HOLDINGS OR COMMERCIAL AGRICULTURE. OTHERS COLLECT DATA ON CHEMICAL FERTILIZER USE AMONG SMALL HOLDERS. BASED ON THESE PIECES OF INFORMATION. WE DECIDED THAT TO DETERMINE THE EXTENT OF LRA BY CROP WITHIN ZONE AND WITHIN A COUNTRY WOULD REQUIRE AN "EXCLUSION PRINCIPLE ". WE STARTED OUT WITH AN ESTIMATE OF TOTAL AREA AND PRODUCTION (WITHIN A ZONE AND A COUNTRY). FROM THIS WE SUBTRACTED ESTIMATES OF CROP AREA WHICH WERE CLEARLY IDENTIFIABLE AS BEING UNDER NON-LRA CONDITIONS. THIS COULD MEAN AREA UNDER COMMERCIAL LARGE FARMS OR AREA UNDER CAPITAL INTENSIVE IRRIGATION . HENCE. OUR RESIDUAL WAS LRA. IN THIS PROCESS WE WERE ABLE TO APPLY A SIMILAR DEFINITION (CONCEPT) ACROSS THE ENTIRE SAMPLE .

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ONCE WE WERE ABLE TO COME UP WITH OUR ESTIMATES OF LRA BY CROP WITHIN ZONE AND COUNTRY. THESE WERE ENTERED INTO A LARGE SPREADSHEET WHIC ENABLED US TO AGGREGATE ACROSS CROP AND WITHIN AGROECOLOGICAL ZONE. THES ARE THE ACCOMPANYING TABLES AND ARE DESCRIBED BELOW.

IV. ASSEMBLING THE DATA IN THE LOTUS SPREADSHEET.

THE MAIN LOTUS SPREADSHEET IS DIVIDED INTO 3 PARTS.

TABLE 1. IS AN INDICATOR OF DATA AVAILABILITY BY CROP. BY ZONE AND COUNTRY.

TABLE 2. SHOWS AGGREGATE STATISTICS OF CROP PRODUCTION BY CROP WITHIN ZON AND COUNTRY.

TABLE 3. SHOWS LRA ESTIMATES ON CROP PRODUCTION BY CROP WITHIN ZONE AN COUNTRY.

TABLE 3 ALSO CONTAINS 3 COLUMNS ON THE EXTREME RIGHT WHICH SHOW

a) THE SUM OF ALL LRA AREA AND PRODUCTION CROP (OVER ALL COUNTRIES) WITHIN A ZONE.

b) THE SUM OF ALL (LRA AND NON-LRA) AREA AND PRODUCTION OF A PARTICULAR CROP(OVER ALL 8 COUNTRIES) WITHIN A ZONE.

C) LRA AREA AND PRODUCTION AS A PERCENT OF TOTAL AREA AND PROD FO A CROP (OVER ALL 8 COUNTRIES) WITHIN A ZONE.

THESE DATA (I.E. THE PERCENTAGES) CAN BE ILLUSTRATED IN VARIOU WAYS. WE HAVE ATTACHED SOME ILLUSTRATIVE PIE-GRAPHS FOR REVIEW PURPOSES. SINCE THE DATA ARE IN LOTUS FORMAT. THEY CAN BE REARRANGED OR RESPECIFIE ACCORDING TO OTA NEEDS.

OTHER MATERIALS SUBMITTED FOR OTA REVIEW.

AS THE MATERIALS COLLECTED WERE QUITE NUMEROUS. WE HAVE BEEN TRYING T SYNTHESIZE THE INFORMATION INTO COUNTRY FILES TO BE SUBMITTED TO OTA. THES COUNTRY FILES WILL BE HARDCOPY MATERIALS (IN ADDITION TO COUNTR INFORMATION SUBMITTED ON DISKETTE) WE HAVE ENCLOSED A SAMPLE OF THE TYPE O INFORMATION THAT WILL BE INCLUDED IN COUNTRY FILES. THIS RANGES FROM A INDEX. TO MAPS AND TO COUNTRY NOTES. WE NEED TO WORK WITH OTA ON TH SYNTHESIS OF MATERIALS AND THE ORGANIZATION OF DATA INTHE DISKETTES SO THA MATERIALS WILL BE PERTINENT TO OTA NEEDS. WE HOPE THAT THIS WILL B ACCOMPLISHED DURING THE NEXT FEW DAYS.

NOTE: AS WE NOW HAVE ALL THE AGGREGATE LRA DATA IN SPREADSHEET FORMAT. TH FORMAT NEEDS TO BE AGREED UPON. WE CAN MAKE A SERIES OF FURTHER COMPUTATI FROM THE PRESENT DATA FOR THE FINAL PRODUCT. THIS CAN BE DETERMINED JOINTL BETWEEN OTA AND OURSELVES.

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(ASA)

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CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe
Millet									
	area	X	X	X	X	X			
	prod	X	X	X	X	X			
Sorghum									
	area	X	X	X	X				X
	prod	X	X	X	X				X
Cowpeas									
	area			X					
	prod			X					
Groundnuts									
	area	X	X	X	X				X
	prod	X	X	X	X				X
Pulses									
	area								
	prod								
Wheat									
	area			X	X				X
	prod			X	X				X
Rice									
	area	X	X	X		X			
	prod	X	X	X		X			
Maize									
	area	X	X	X		X			X
	prod	X	X	X		X			X
Cotton									
	area		X	X	X	X			
	prod		X	X	X	X			
Fonio									
	area		X						
	prod		X						
Soya									
	area								X
	prod								X
Tobacco									
	area								X
	prod								X
Sesame									
	area				X				
	prod				X				
Sisal									
	area					X			
	prod					X			

Table 1.

SEASONALLY
HUMID (SHT)

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CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe
Maize									
	area	X	X	X	X		X	X	X
	prod	X	X	X	X		X	X	X
Rice									
	area	X	X	X			X	X	
	prod	X	X	X			X	X	
Millet									
	area	X		X	X				
	prod	X		X	X				
Sorghum									
	area	X	X	X	X				
	prod	X	X	X	X				
Groundnuts									
	area	X	X	X	X	X	X	X	
	Prod	X	X	X	X	X	X	X	
Palmoil									
	area						X		
	prod						X		
Coffee									
	area						X		
	prod						X		
Beans									
	area						X		X
	prod						X		X
Cassava									
	area						X	X	X
	prod						X	X	X
Rubber									
	area						X		
	prod						X		
Cotton									
	area		X					X	
	prod		X					X	
Tobacco									
	area							X	
	prod							X	
Sesame									
	area								
	prod								
Yams									
	area			X					
	prod			X					
Cocoyams									
	area			X					
	prod			X					

[redacted]

Table 1

HUMID COASTAL LOWLANDS
(HCL+HEL)

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	COUNTRY	**Senegal**	**Mali**	**Nigeria**	**Sudan**	**Kenya**	**Zaire**	**Malawi**	**Zimbabwe**
CROP									
Maize									
	area			X			X		
	prod			X			X		
Rice									
	area			X			X		
	prod			X			X		
Groundnuts									
	area						X		
	Prod						X		
Cassava									
	area			X			X		
	prod			X			X		
Beans									
	area						X		
	prod						X		
Rubber									
	area			X			X		
	prod			X			X		
Coffee									
	area						X		
	prod						X		
Palmoil									
	area			X			X		
	prod			X			X		
Yams									
	area			X					
	prod			X					
Cocoyams									
	area			X					
	prod			X					

HIGHLANDS

Table :

Draft

CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe
Sisal									
	area								
	prod					X			
Tea									
	area					X	X	X	
	prod					X	X	X	
Coffee									
	area					X			
	prod					X			
Scane									
	area					X			
	prod					X			
Wheat									
	area					X			
	prod					X			
Cotton									
	area					X			
	prod					X			
Rice									
	area					X			
	prod					X			
Maize									
	area					X			
	prod					X			
Pineapples									
	area					X			
	prod					X			
Millet									
	area					X			
	prod					X			
Potatoes									
	area					X			
	prod					X			

[redacted]

ZONE:

ARID, SEMI-ARID
(ASA)

TABLE 2: AGGREAGATE AREA AND PRODUCTION STATISTICS
BY REGION AND CROP
(AREA IN '000 HA)
(PROD IN '000 M. TONS)

CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	TOTALS BY ROW
Millet										
	area	530	552	4,527	1,157	16				6,782
	prod	321	575	2,947	404	42				4,289
										0
Sorghum										0
	area	530	322	2,020	2,090				41	5,003
	prod	321	365	1,310	1,288				42	3,326
										0
Cowpeas										0
	area									0
	prod									0
										0
Groundnuts										0
	area	904	127	360	756				29	2,176
	prod	756	153	366	574				33	1,882
										0
Pulses										0
	area									0
	prod									0
										0
Wheat										0
	area			10	142				20	172
	prod			30	168				37	235
										0
Rice										0
	area	12	106							117
	prod	42	152							194
										0
Maize										0
	area	35	33	270		289			550	1,177
	prod	42	62	262		452			423	1,241
										0
Cotton										0
	area	13	64	386	498	84			28	1,073
	prod	14	79	56	1,653	12			21	1,835
										0

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ZONE:

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(ASA)

TABLE 2: (CONT'D) AGGREAGATE AREA AND PRODUCTION STATISTICS
BY REGION AND CROP
(AREA IN '000 HA)
(PROD IN '000 M. TONS)

	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	TOTALS BY ROW
CROP										
	area		54							54
	prod		39							39
Soya										0
										0
	area								8	8
	prod								11	11
Tobacco										0
										0
	area									0
	prod									0
										0
Sesame										0
	area				550					512
	prod				117					117
										0
Sisal										0
	area					62				62
	prod					34				34
Coffee										
	area					20				20
	prod					11				11
										0
										0

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ZONE: TABLE 2: AGGREAGATE AREA AND PRODUCTION STATISTICS 0
(CONT'D) BY REGION AND CROP 0
(AREA IN '000 HA) 0
SEASONALLY (PROD IN '000 M. TONS) 0
HUMID (SHT) 0
0

	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	
										0
CROP										0
										0
Maize										0
	area	21	10	720	X		594	773	756	2,874
	prod	27	41	700	X		416	922	1,362	3,468
										0
Rice										0
	area	58	6	260			414	15		753
	prod	78	6	551			298	22		956
										0
Millet										0
	area	59		503	32					594
	prod	47		328	10					385
										0
Sorghum										0
	area	59	17	3,030	357				47	3,510
	prod	47	20	1,965	131				75	2,238
										0
Groundnuts										0
	area	107	8	240	104		171	139	72	839
	Prod	114	12	244	30		120	56	82	658
										0
Palmoil										0
	area						X			0
	prod						22			22
										0
Coffee										0
	area						17			17
	prod						7			7
										0
Beans										0
	area						50		66	116
	prod						25		78	103
										0
Cassava										0
	area			250			638	X		888
	prod			2,340			4,466	X		6,806
										0
Rubber										0
	area						X			0

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ZONE:

SEASONALLY
HUMID (SHT)

TABLE 2:
(CONT'D)

AGGREAGATE AREA AND PRODUCTION STATISTICS
BY REGION AND CROP
(AREA IN '000 HA)
(PROD IN '000 M. TONS)

CROP	COUNTRY	Senegal'	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	
Cotton										0
	area	27	42	43				X	89	201
	prod	20	50	6				X	133	208
										0
Tobacco										0
	area							62	54	116
	prod							54	93	147
										0
Sesame										0
	area				69					69
	prod				20					20
										0
Yams										0
	area			465						465
	prod			5550						5,550
										0
Cocoyams										0
	area			66						66
	prod			370						370
										0
										0
										0

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ZONE

CONTINUOUSLY HUMID
(HCL+HEL)

TABLE 2:
(CONT'D)

AGGREGATE AREA AND PRODUCTION STATISTICS
BY REGION AND CROP
(AREA IN '000 HA)
(PROD IN '000 M. TONS)

										0
										0
										0
	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	0
										0
CROP										0
										0
Maize										0
	area			810			149			959
	prod			787			104			891
										0
Rice										0
	area			390			273			663
	prod			825			268			1,093
										0
Groundnuts										0
	area						339			339
	Prod						237			237
										0
Cassava										0
	area			1,000			1,387			2,387
	prod			9,360			9,075			18,435
										0
Beans										0
	area						136			136
	prod						68			68
										0
Rubber										0
	area						1			0
	prod			70			16			86
										0
Coffee										0
	area						192			192
	prod						82			82
										0
Palmoil										0
	area						1			0
	prod			525			138			663
										0
Yams										0
	area			1085						1,085
	prod			12950						12,950
										0
Cocoyams										0
	area			264						264
	prod			1480						1,480

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TABLE 2: (CONT'D)

AGGREGATE AREA AND PRODUCTION STATISTICS
BY REGION AND CROP
(AREA IN '000 HA)
(PROD IN '000 M. TONS)

ZONE	CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	
											0
HIGHLANDS											0
											0
											0
											0
											0
											0
	Sisal										0
		area					35				35
		prod					16				16
											0
	Tea										0
		area					62	1	18		80
		prod					96	1	30		126
											0
	Coffee										0
		area					90	46			136
		prod					66	18			84
											0
	Scane										0
		area					41				41
		prod					3,107				3,107
											0
	Wheat										0
		area					103				103
		prod					222				222
											0
	Cotton										0
		area					84				84
		prod					12				12
											0
	Rice										0
		area					8				8
		prod					39				39
											0
	Maize										0
		area					1,071				1,071
		prod					1,998				1,998
											0
	Pineapples										0
		area					5				5
		prod					155				155
											0
	Millet										0
		area					62				62
		prod					240				240
											0
	Potatoes										0
		area				1					0
		prod				1					0

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ZONE:

TABLE 3:

STATISTICS ON LOW RESOURCE AGRICULTURE BY ZONE AND CROP WITHIN COUNTRIES

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ARID, SEMI-ARID
(ASA)

CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	----TOTALS ---BY ROW ----LRA----	----TOTAL ---BY-- ----ZONE---	--PERCENT LRA ---IN SAMPLE ---COUNTRIES---
Millet												
	area	212	576	3,169	1,157	16				5129.6	4,782	75.6307735
	prod	128	552	2,063	404	42				3189	4,289	74.3529960
										0	0	ERR
Sorghum										0	0	ERR
	area	212	389	1,414	950				20	2985	5,003	59.6684831
	prod	128	358	917	629				15	2047	3,326	61.5403116
										0	0	ERR
Cowpeas										0	0	ERR
	area									0	0	ERR
	prod									0	0	ERR
										0	0	ERR
Groundnuts										0	0	ERR
	area	181	127	216	642			2	20	1187.6	2,176	54.5797141
	prod	150	153	220	374			1	22	919.9	1,882	48.8736584
										0	0	ERR
Pulses										0	0	ERR
	area									0	0	ERR
	prod									0	0	ERR
										0	0	ERR
Wheat										0	0	ERR
	area									0	172	0
	prod									0	235	0
										0	0	ERR
Rice										0	0	ERR
	area		58					1		58.8	117	50.1706484
	prod		85					1		86.2	194	44.5247933
										0	0	ERR
Maize										0	0	ERR
	area	35	33	54		100		20	165	406.7	1,177	34.5598232
	prod	42	62	53		120		12	150	438.8	1,241	35.3585817
										0	0	ERR
Cotton										0	0	ERR
	area	3	14	193		84				293	1,073	27.3168002
	prod	3	17	28		12				59.5	1.835	3.24286075

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TABLE 3 (contd)

		MALI	SUDAN			
Fonio				0	0	ERR
	area	54		54	54	100
	prod	39		39	39	100
				0	0	ERR
Soya				0	0	ERR
	area			0	8	0
	prod			0	11	0
				0	0	ERR
Tobacco				0	0	ERR
	area			0	0	ERR
	prod			0	0	ERR
				0	0	ERR
Sesame				0	0	ERR
	area		244	244	550	47.65625
	prod		72	72	117	61.5384615
				0	0	ERR
Sisal				0	0	ERR
	area			0	62	0
	prod			0	34	0
Coffee						
	area			0	20	0
	prod			0	11	0

TABLE 3 (contd)

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										0	0	ERR
										0	0	ERR
SEASONALLY										0	0	ERR
HUMID (SHT)										0	0	ERR
										0	0	ERR
	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	0	0	ERR
										0	0	ERR
CROP										0	0	ERR
										0	0	ERR
Maize										0	0	ERR
	area	21	10	504			384	537	135	1590.8	2,874	55.3495007
	prod	27	41	490			269	322	150	1298.8	3,468	37.4477409
										0	0	ERR
Rice										0	0	ERR
	area	57	6	247			37	2		349.3	753	46.4118201
	prod	77	6	524			27	2		635.7	956	66.5027722
										0	0	ERR
Millet										0	0	ERR
	area	23		352	32					407	594	68.5762426
	prod	19		230	10					259	385	67.2029060
										0	0	ERR
Sorghum										0	0	ERR
	area	23		1,818	273				20	2134	3,510	60.8060361
	prod	19		1,179	81				35	1314	2,238	58.7105133
										0	0	ERR
Groundnuts										0	0	ERR
	area	21	8	144	105		154	138	50	619.6	839	73.8269427
	Prod	23	12	98	30		108	56	67	393.1	658	59.7634395
										0	0	ERR
Palmoil										0	0	ERR
	area									0	0	ERR
	prod						22			22	22	99.4125621
										0	0	ERR
Coffee										0	0	ERR
	area						17			17.4	17	100
	prod						7			6.5	7	100
										0	0	ERR
Beans										0	0	ERR
	area						45			44.7	116	38.5743872
	prod						22			22.3	103	21.6960281
										0	0	ERR
Cassava										0	0	ERR
	area			238			574			812	888	91.4414414
	prod			2,223			4,020			6243	6,806	91.7278071
										0	0	ERR
Rubber										0	0	ERR
	area									0	0	ERR
	prod									0	2	0

TABLE 3 (contd)

Draft

ZONE: SHT.

		MALI	NIGERIA	SUDAN			
Cotton					0	0	ERR
	area	4	22		25.9	201	12.9112662
	prod	2	3		5.4	208	2.59065255
					0	0	ERR
Tobacco					0	0	ERR
	area				0	116	0
	prod				0	147	0
					0	0	ERR
Sesame					0	0	ERR
	area			69	69	69	100
	prod			20	20	20	100
					0	0	ERR
Yams					0	0	ERR
	area		419		419	419	90.1075268
	prod		4995		4995	4995	90
					0	0	ERR
Cocoyams					0	0	ERR
	area		59		59	59	89.3939393
	prod		333		333	333	90
					0	0	ERR

CONTINUOUSLY HUMID
(HCL+HEL)

TABLE 3 (CONT'D)

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CROP	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe			
										0	0	ERR
										0	0	ERR
										0	0	ERR
CROP										0	0	ERR
										0	0	ERR
Maize										0	0	ERR
	area			567			102			669	959	69.7601668
	prod			551			71			622	891	69.8092031
										0	0	ERR
Rice										0	0	ERR
	area			351			246			597	663	90.0724200
	prod			743			241			984	1,093	90.0109769
										0	0	ERR
Groundnuts										0	0	ERR
	area						305			305	339	90.0050166
	Prod						213			213	237	90.0443880
										0	0	ERR
Cassava										0	0	ERR
	area			950			1,249			2199	2,387	92.1240050
	prod			8,892			8,167			17059	18,435	92.5359370
										0	0	ERR
Beans										0	0	ERR
	area						122			122	136	89.8379970
	prod						61			61	68	90.1167085
										0	0	ERR
Rubber										0	0	ERR
	area									0	0	ERR
	prod			50						50	86	58.2072176
										0	0	ERR
Coffee										0	0	ERR
	area						192			192	192	100
	prod						82			81.7	82	99.6341463
										0	0	ERR
Palmoil										0	0	ERR
	area									0	0	ERR
	prod			420			96			516	663	77.8230542
										0	0	ERR
Yams										0	0	ERR
	area			977						977	977	90.0460829
	prod			11655						11655	11655	90
										0	0	ERR
Cocoyams										0	0	ERR
	area			238						238	238	90.1515151
	prod			1332						1332	1332	90
										0	0	ERR
										0	0	ERR

HIGHLANDS

TABLE 3 (contd)

Draft

	COUNTRY	Senegal	Mali	Nigeria	Sudan	Kenya	Zaire	Malawi	Zimbabwe	v	v	-----
										0	0	ERR
CROP										0	0	ERR
										0	0	ERR
Sisal										0	0	ERR
	area									0	35	0
	prod									0	16	0
										0	0	ERR
Tea										0	0	ERR
	area					31				31	80	38.8471177
	prod					40				40	126	31.8725099
										0	0	ERR
Coffee										0	0	ERR
	area						136			136	136	100
	prod						84			84	84	99.6441281
										0	0	ERR
Scane										0	0	ERR
	area					21				20.5	41	50
	prod					1,550				1550	3,107	49.8873511
										0	0	ERR
Wheat										0	0	ERR
	area									0	103	0
	prod									0	222	0
										0	0	ERR
Cotton										0	0	ERR
	area					84				84	84	100
	prod					12				12	12	100
										0	0	ERR
Rice										0	0	ERR
	area									0	8	0
	prod									0	39	0
										0	0	ERR
Maize										0	0	ERR
	area					400				400	1,071	37.3482726
	prod					450				450	1,998	22.5225225
										0	0	ERR
Pineapples										0	0	ERR
	area									0	5	0
	prod									0	155	0
										0	0	ERR
Millet										0	0	ERR
	area					63				62.5	62	100.160256
	prod					90				90	240	37.5
										0	0	ERR
Potatoes										0	0	ERR
	area									0	0	ERR
	prod									0	0	ERR

Draft

Table 4: Agricultural statistics for selected crops in Sub-Saharan Africa (SSA):
Column 2 shows combined area and production statistics for the 8 sample countries (Kenya, Malawi, Mali, Nigeria, Senegal, Sudan, Zaire, Zimbabwe) as a percent of the total for SSA;
Column 3 shows the percent of area and production within the sample countries that is low-resource agriculture (LRA).

crop	sample/SSA (%)	LRA/sample (%)
millet		
area	49	71
production	47	81
sorghum		
area	66	50
production	66	48
groundnuts		
area	69	65
production	78	54
rice		
area	27	83
production	29	89
maize		
area	51	40
production	51	36
cotton		
area	40	35
production	72	5
fonio		
area	NA	100
production	NA	100
sesame		
area	53	37
production	44	47
cassava		
area	50	97
production	52	92
yams		
area	NA	NA
production	76	92
cocoyams		
area	41	84
production	54	97

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Wheat area and prod

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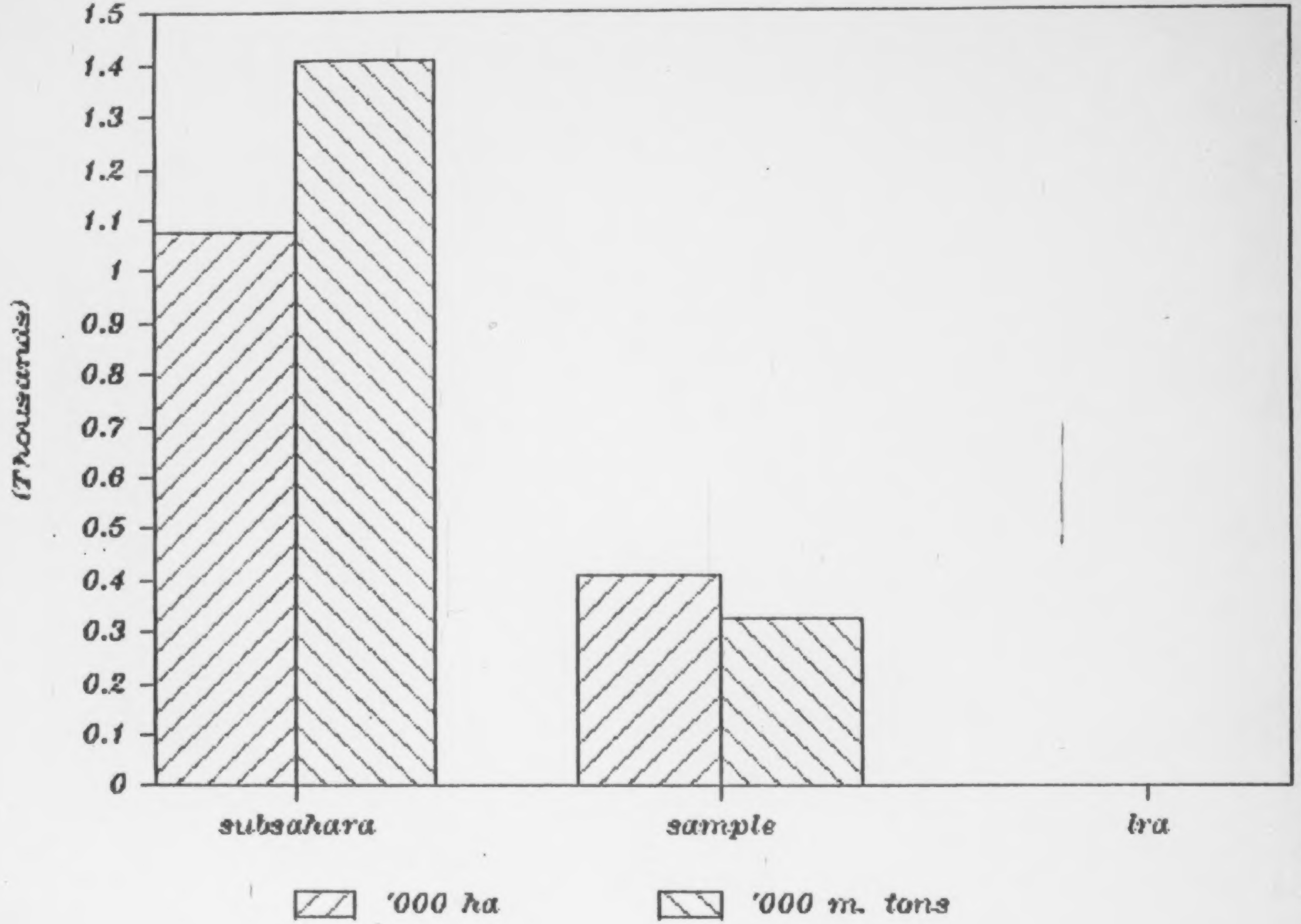

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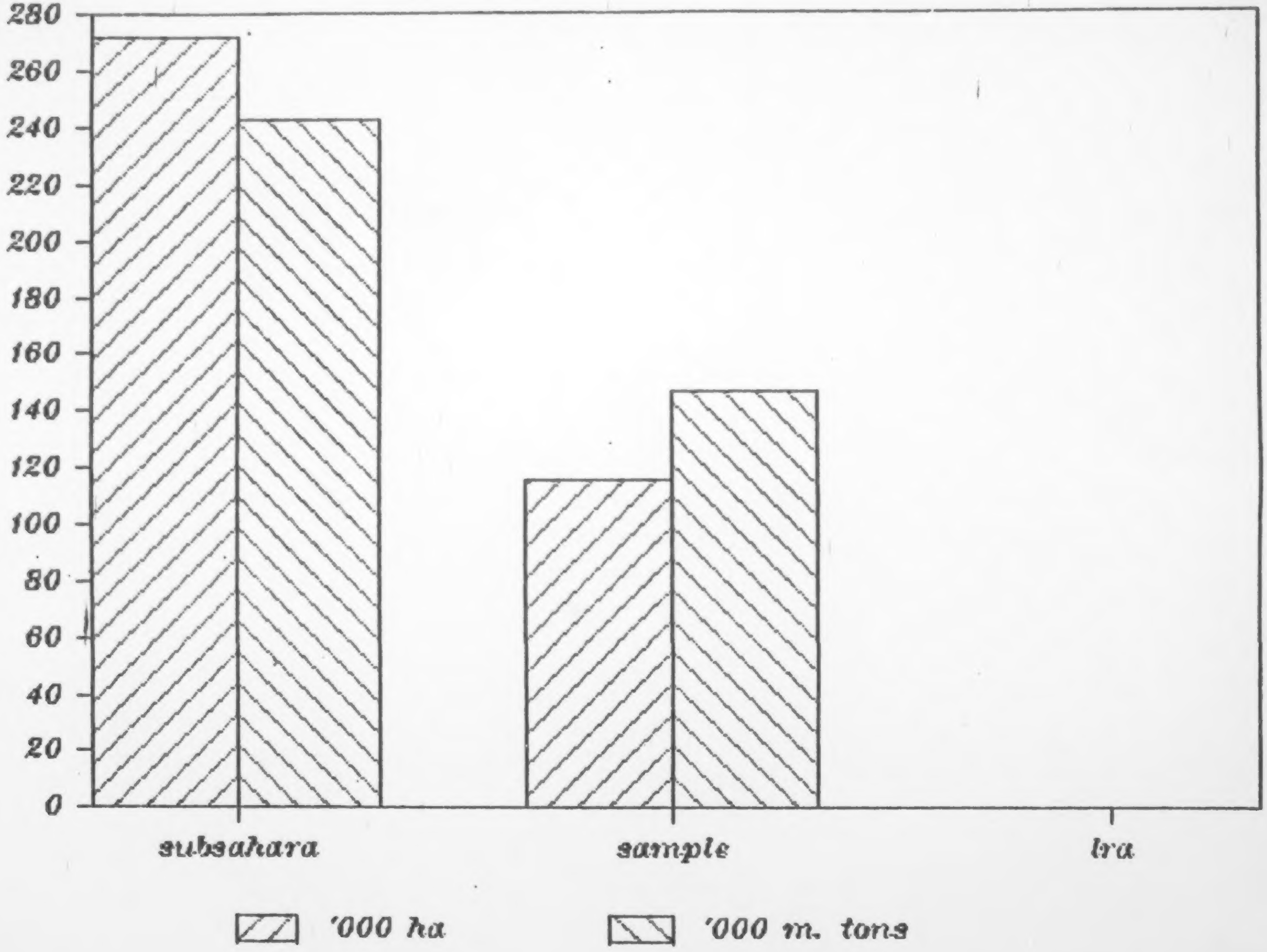
Tobacco area and prod



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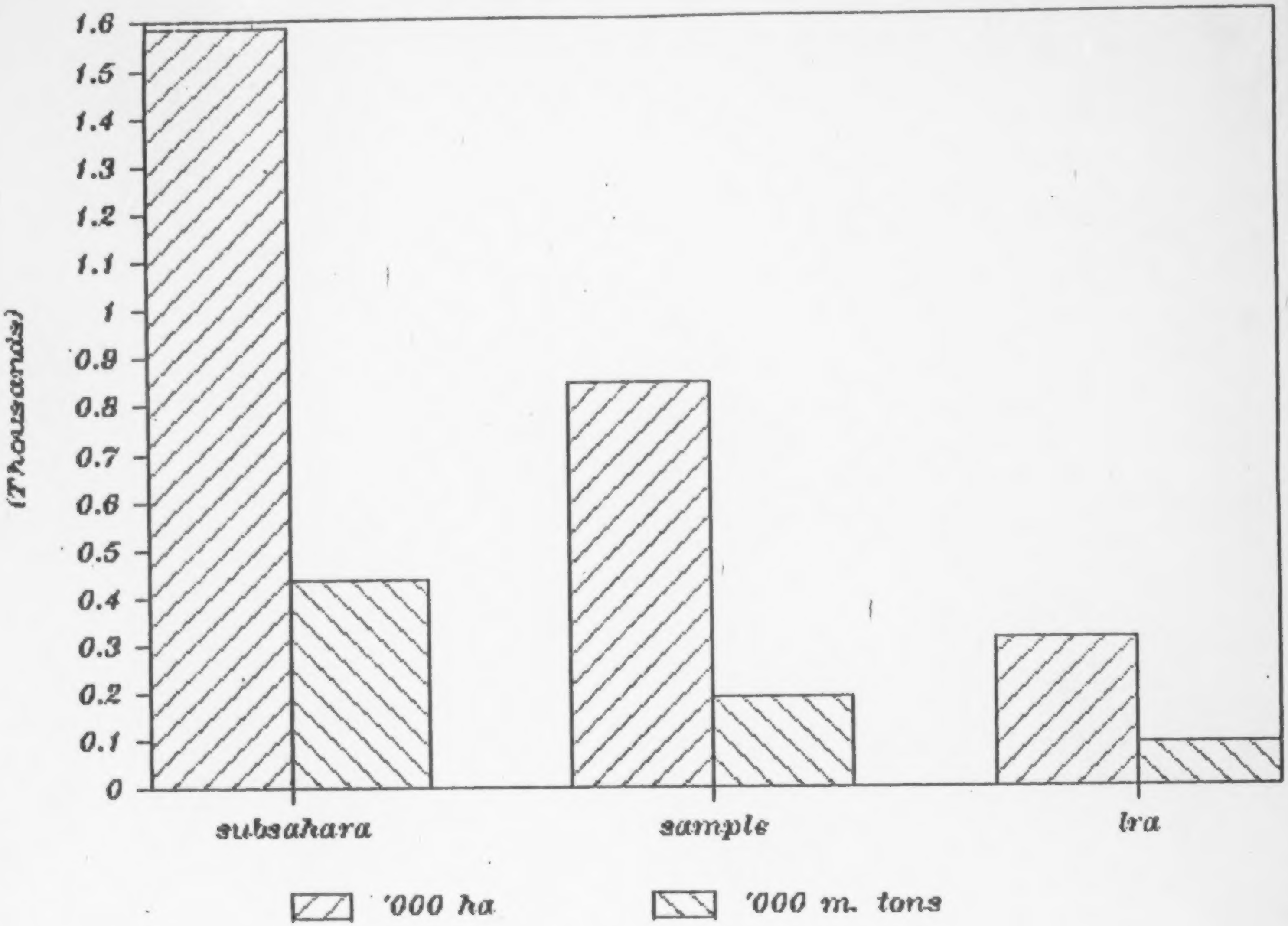
Sesame: area and prod



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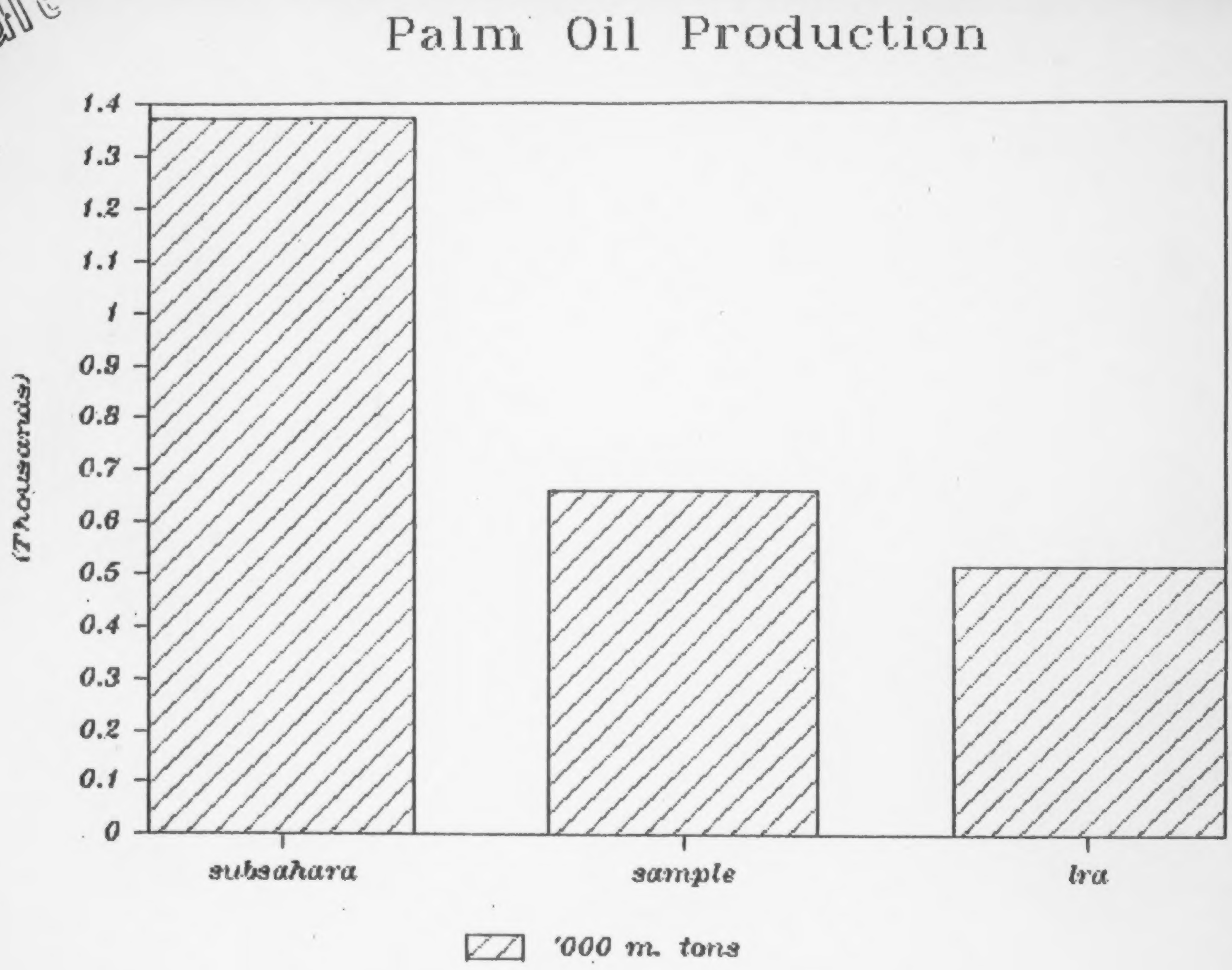
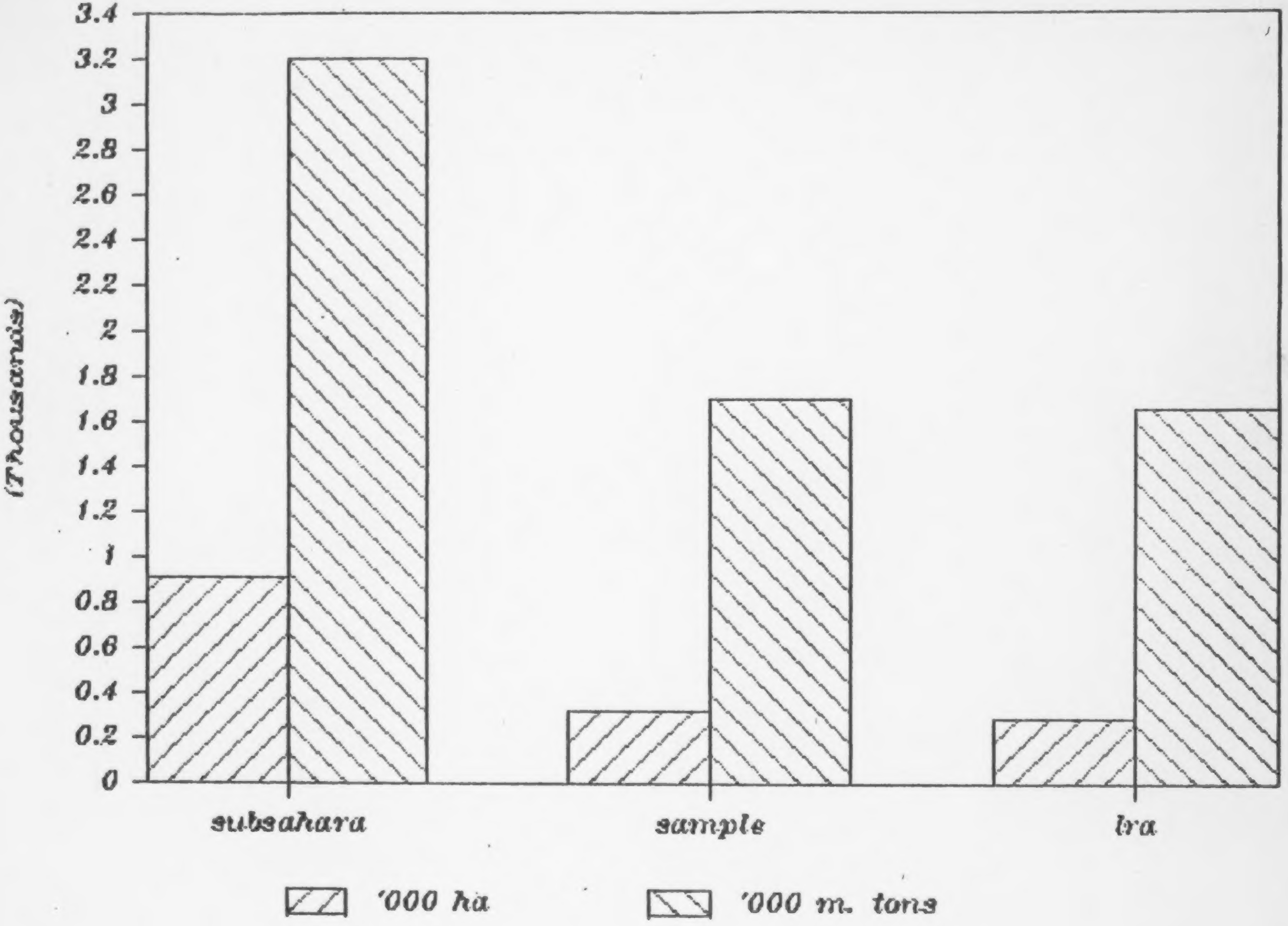

Palm Oil Production
(Thousands)
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
subsahara
sample
ira
'000 m. tons

Draft

Cocoyams area and prod



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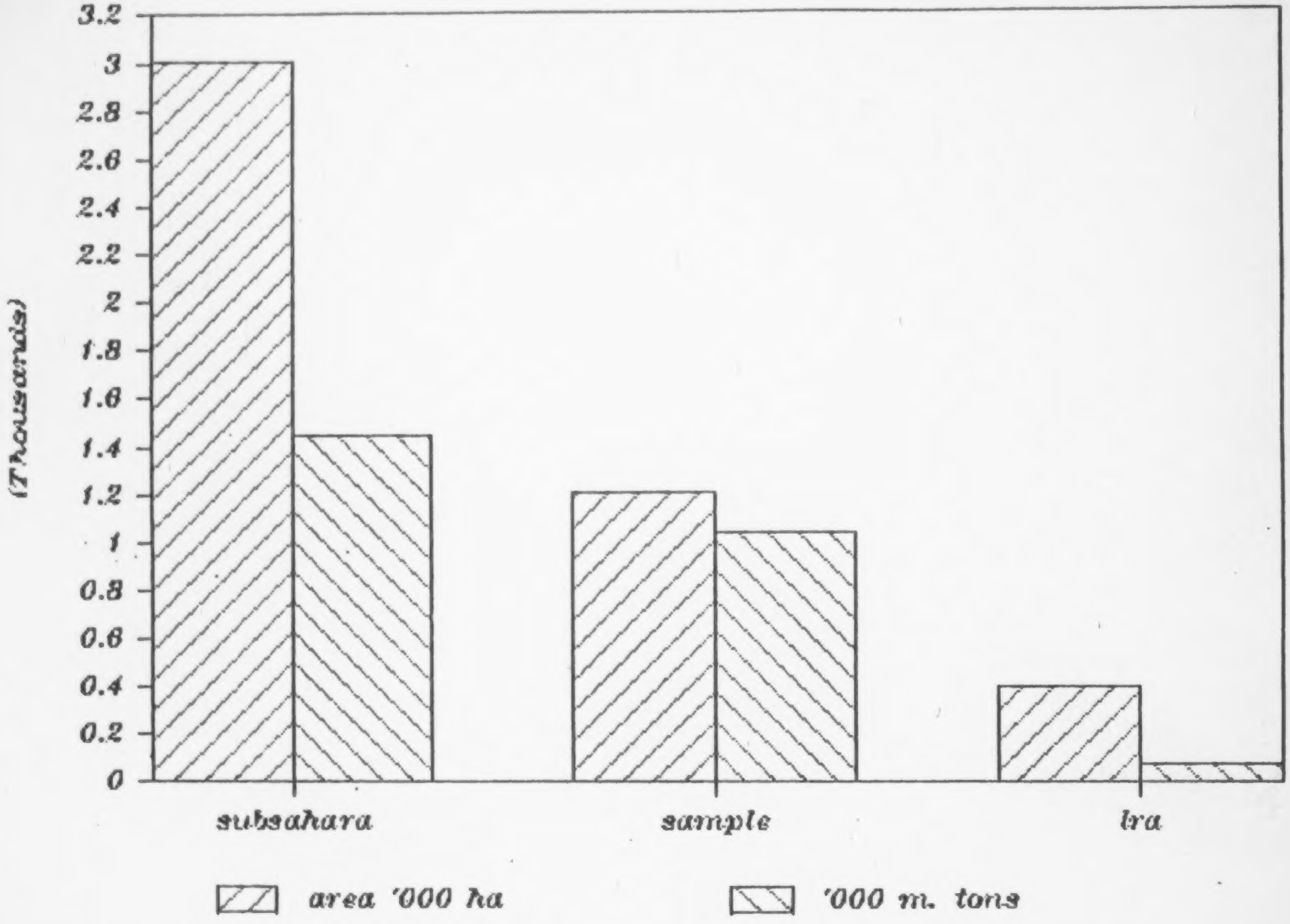
Cotton area and prod



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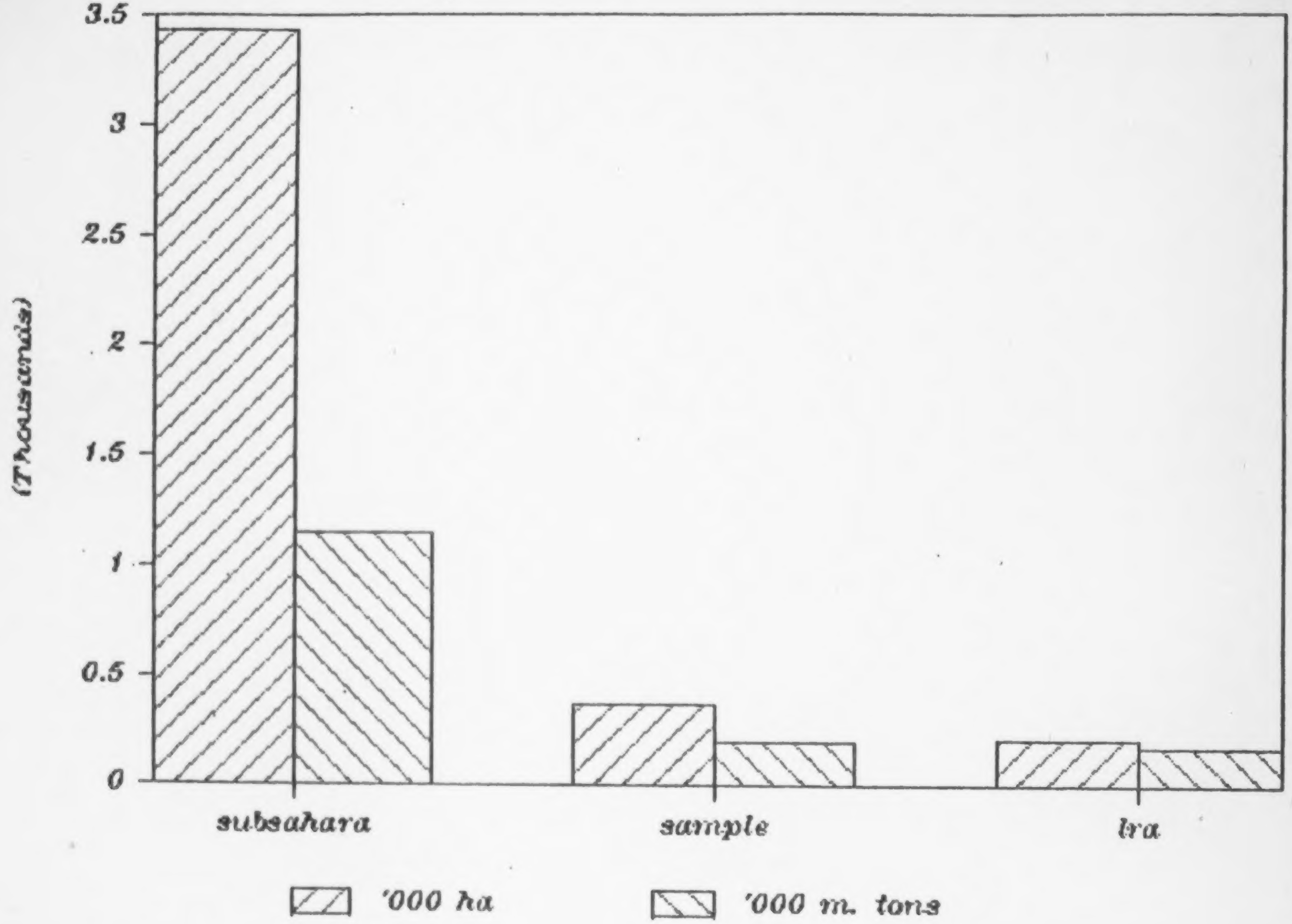
Coffee area and prod



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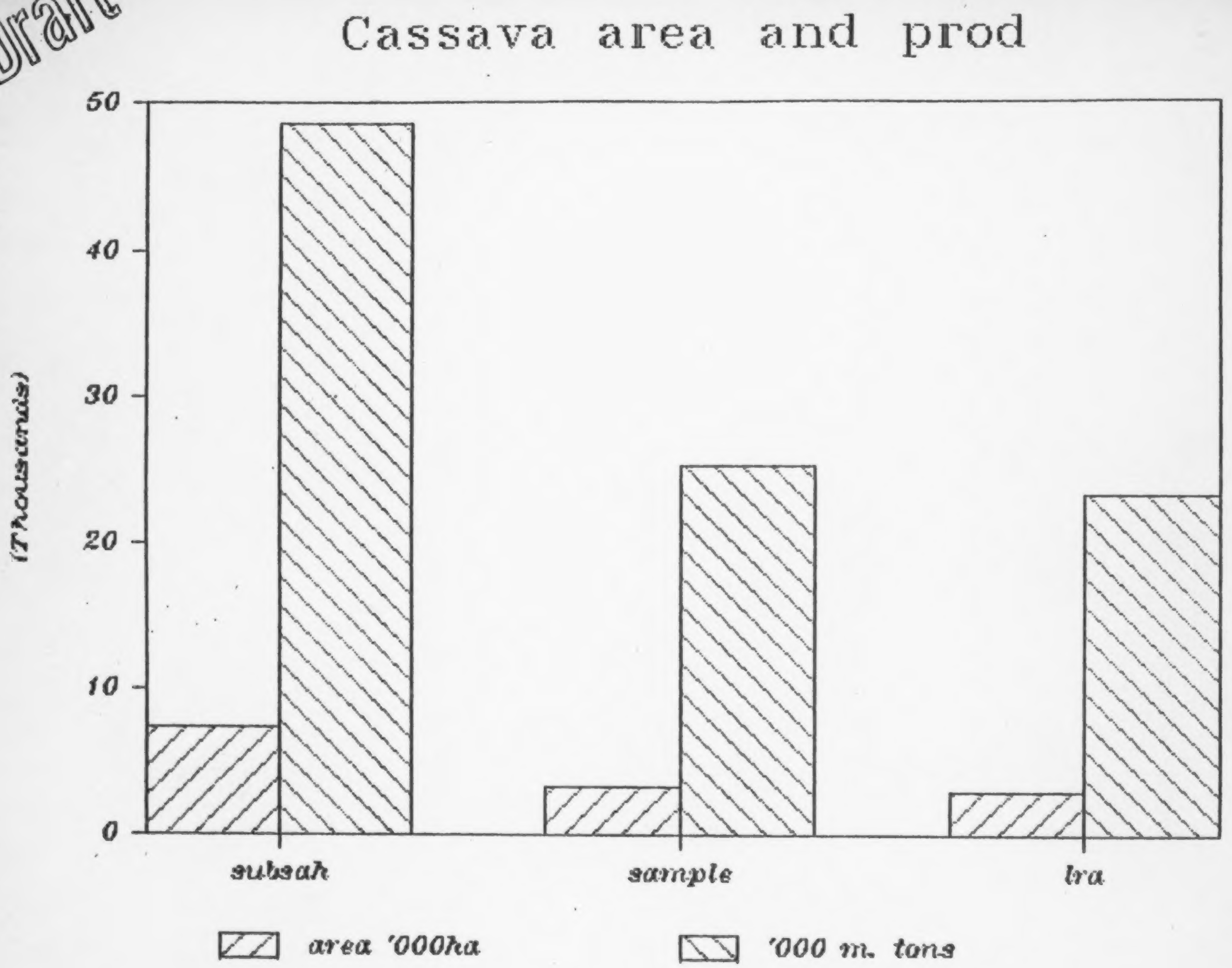
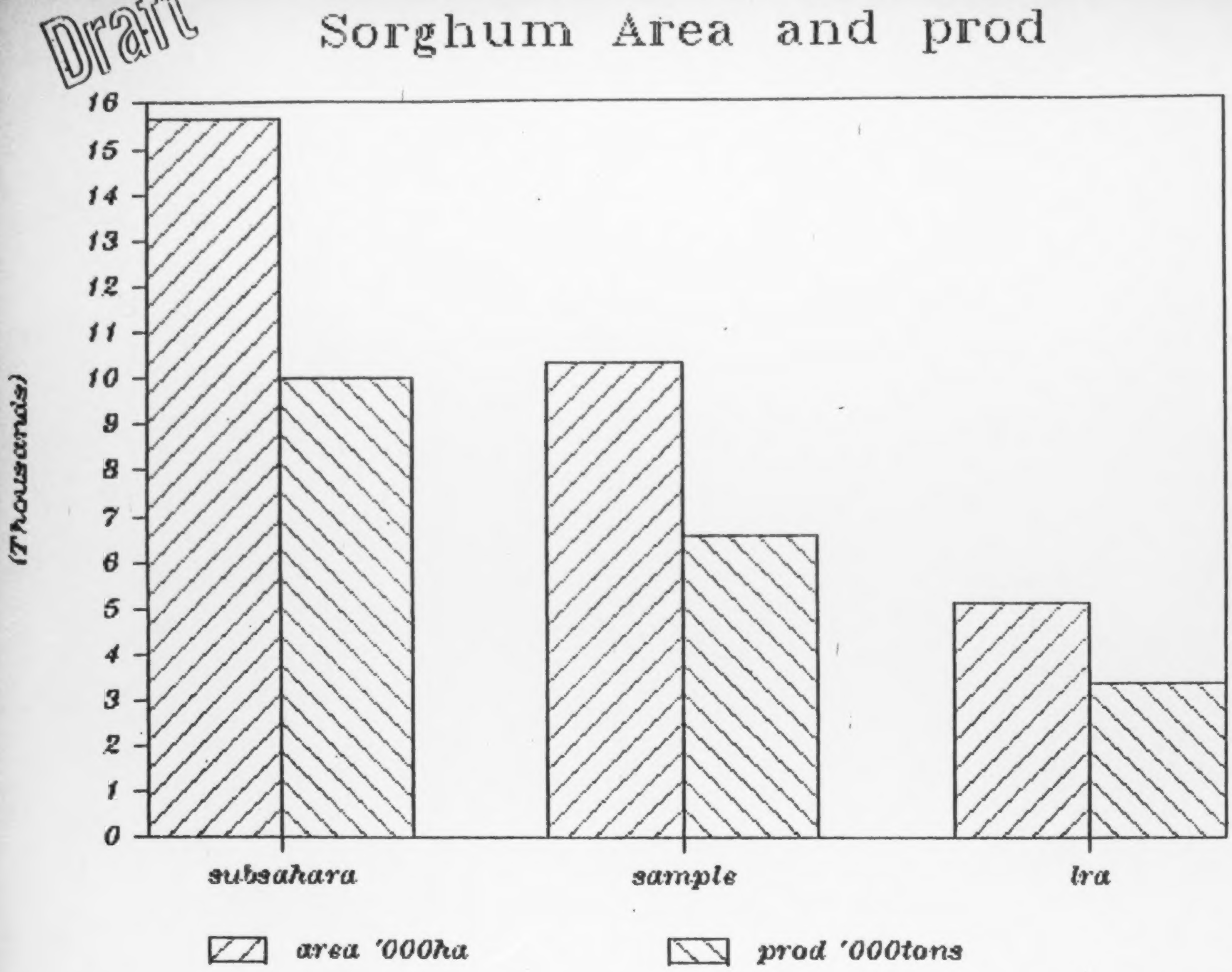
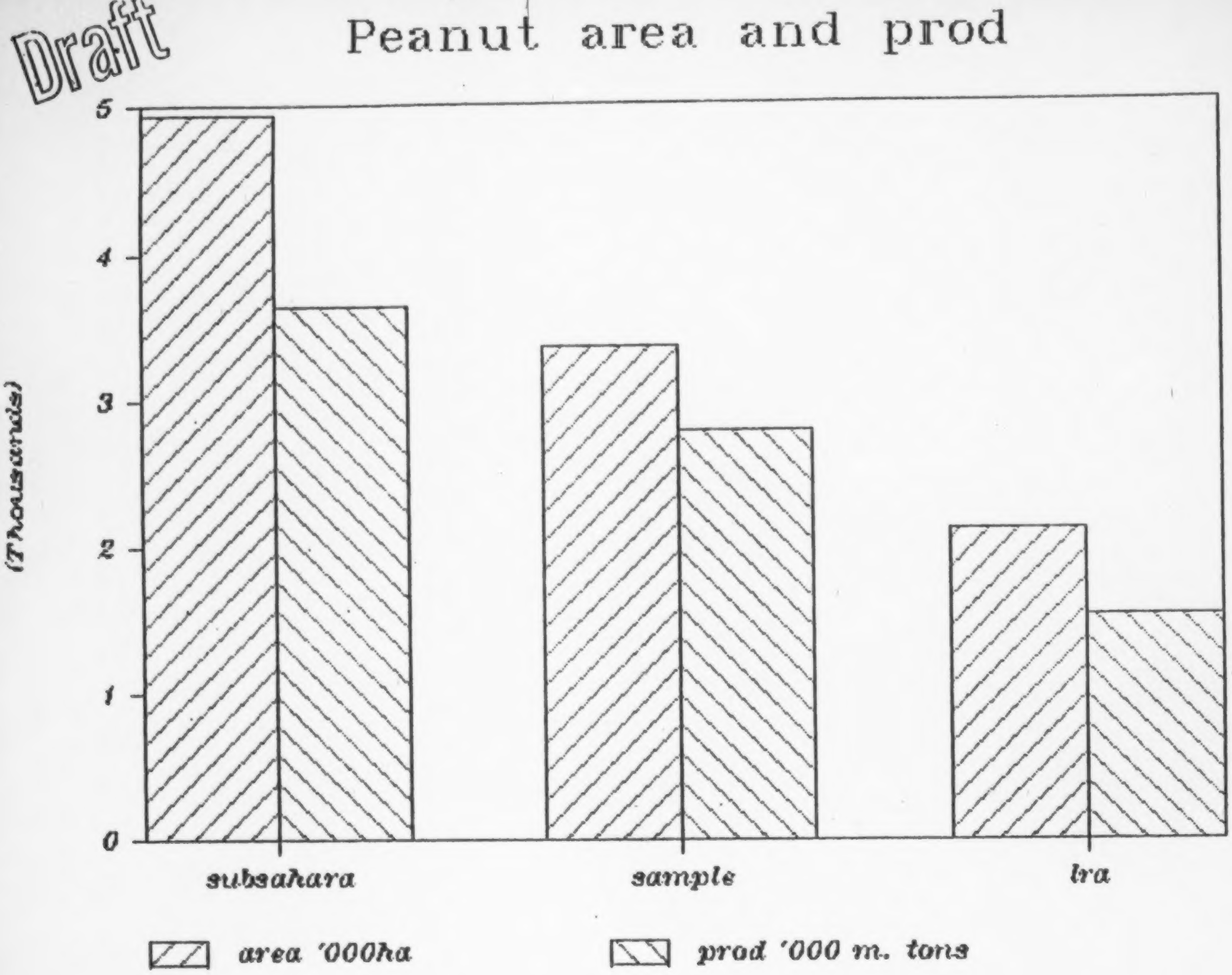

Cassava area and prod
(Thousands)
50
40
30
20
10
0
subsah
sample
lra
area '000ha
'000 m. tons

Draft

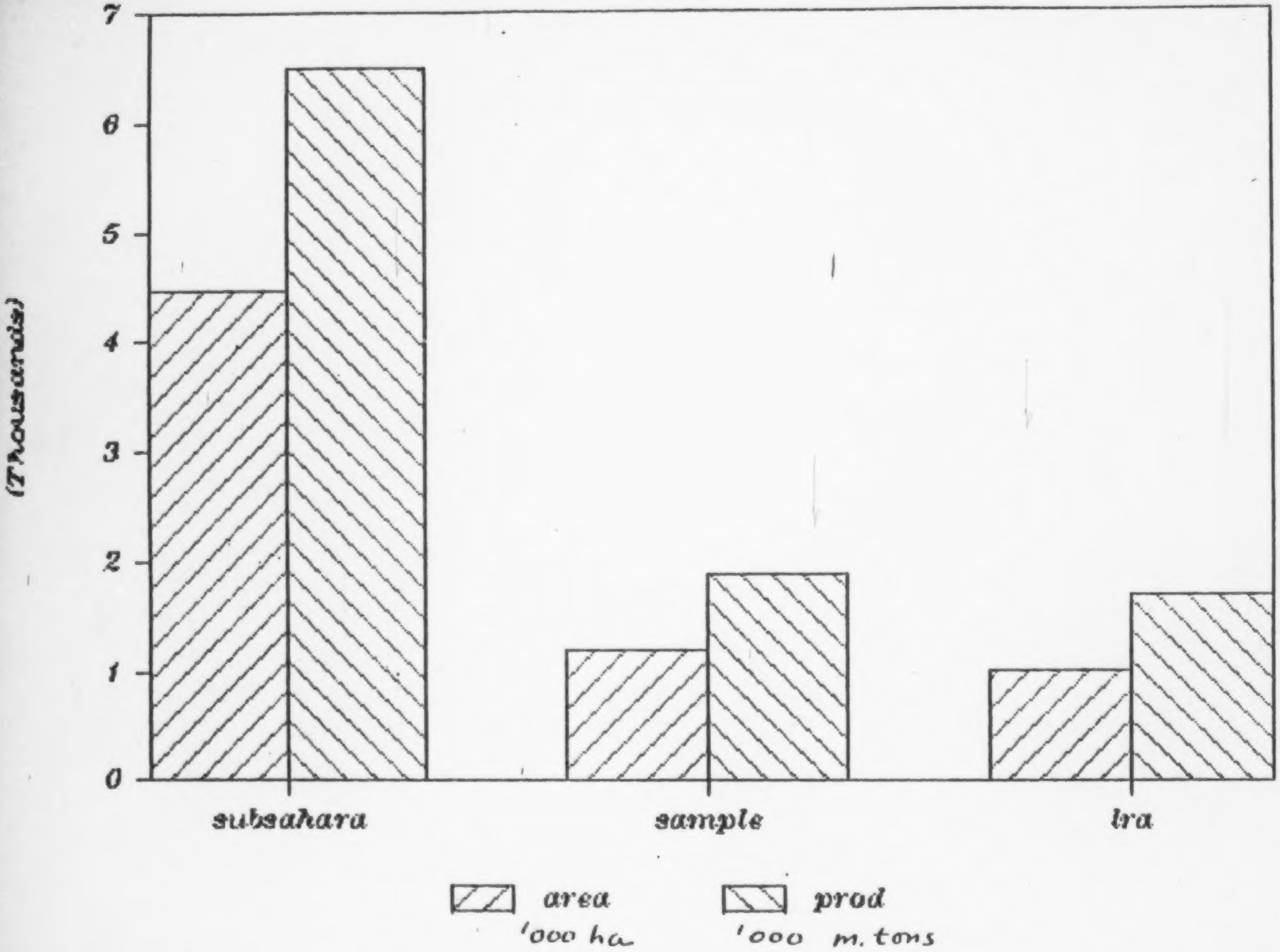

Sorghum Area and prod
(Thousands)
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
subsahara
sample
ira
area '000ha
prod '000tons

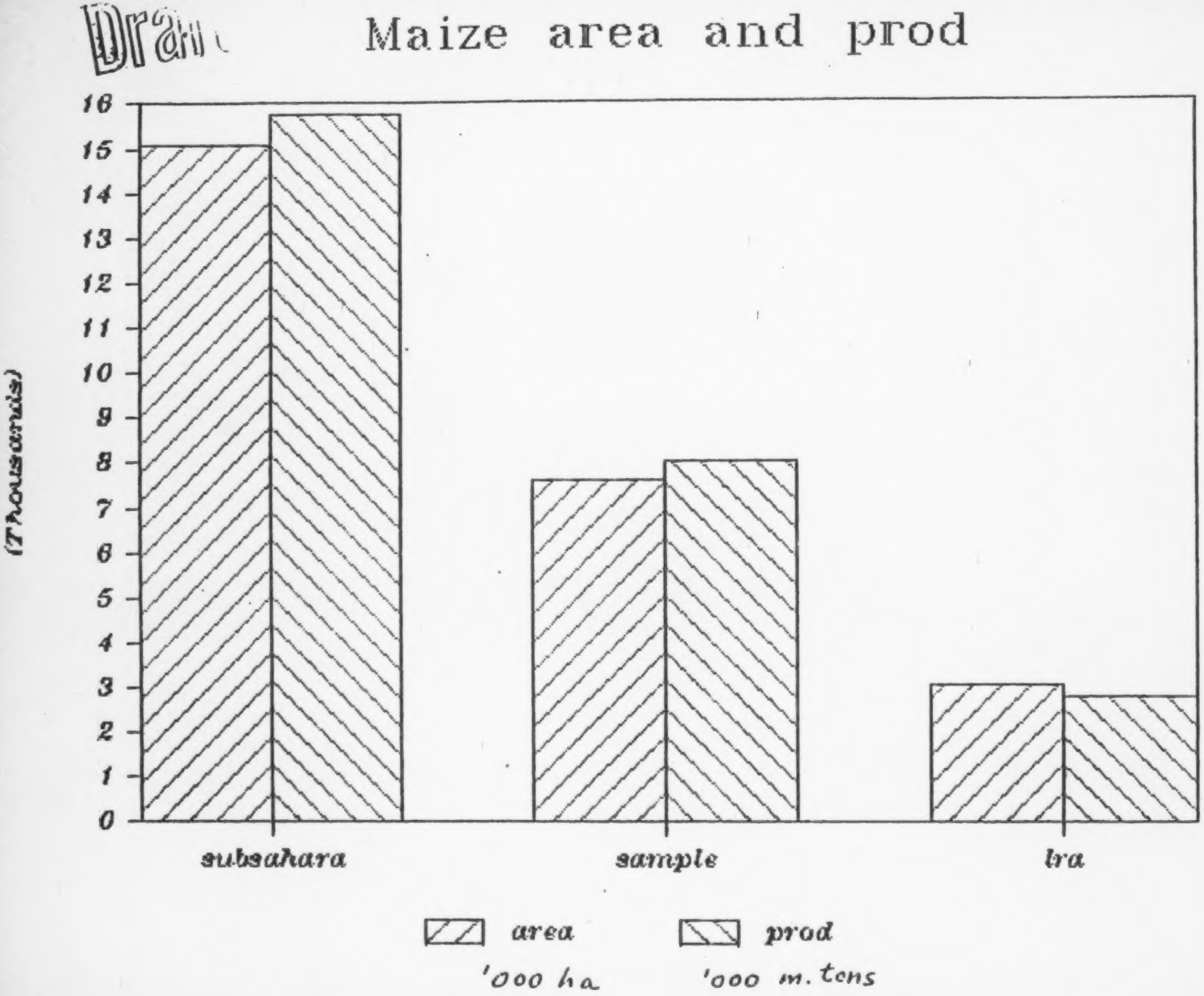
Draft


Peanut area and prod
(Thousands)
0
1
2
3
4
5
subsahara
sample
ira
area '000ha
prod '000 m. tons

Draft

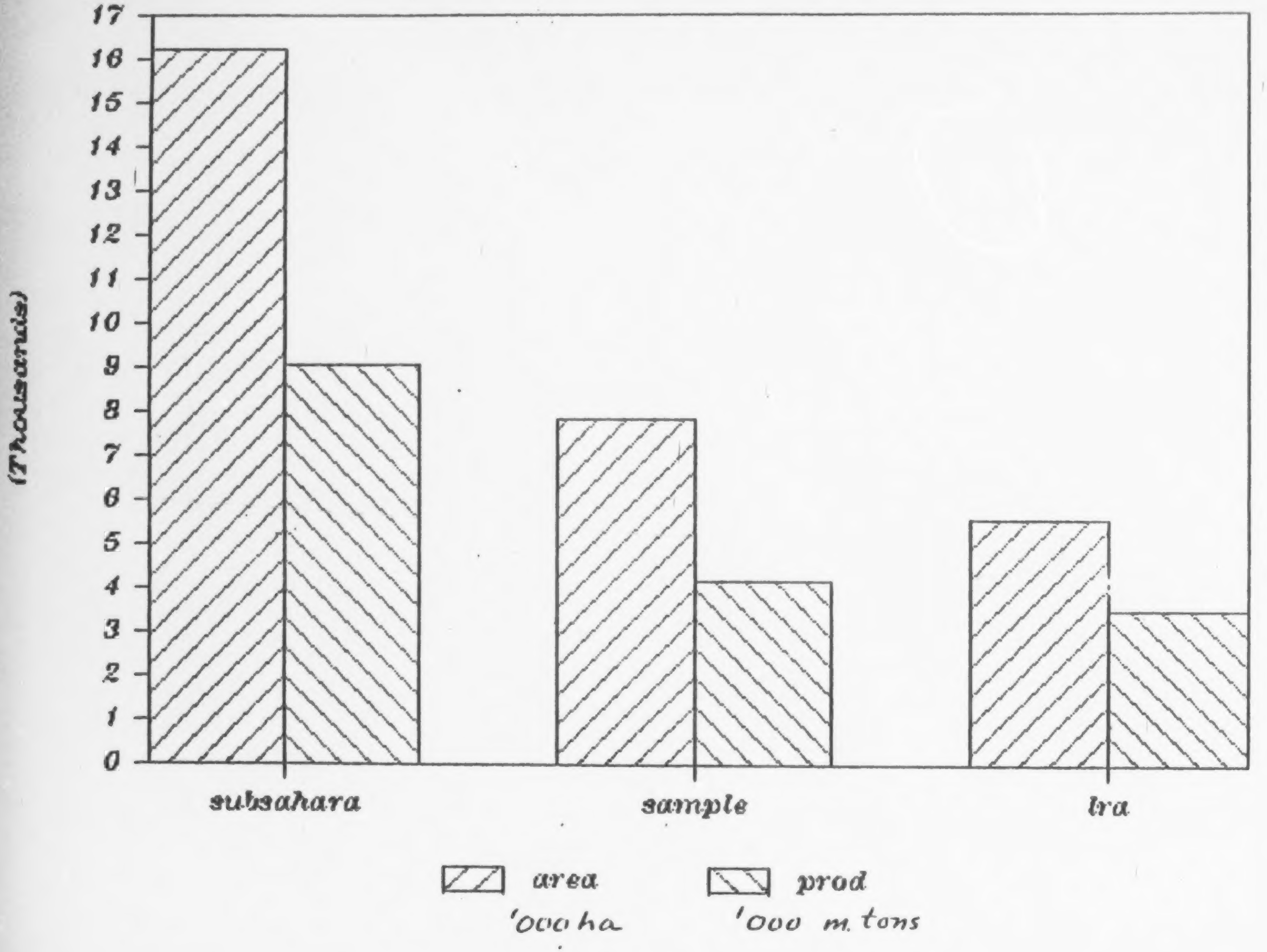
Rice area and prod




Maize area and prod
(Thousands)
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
subsahara
sample
lra
area
prod
'000 ha
'000 m. tons

Draf

Millet area and prod



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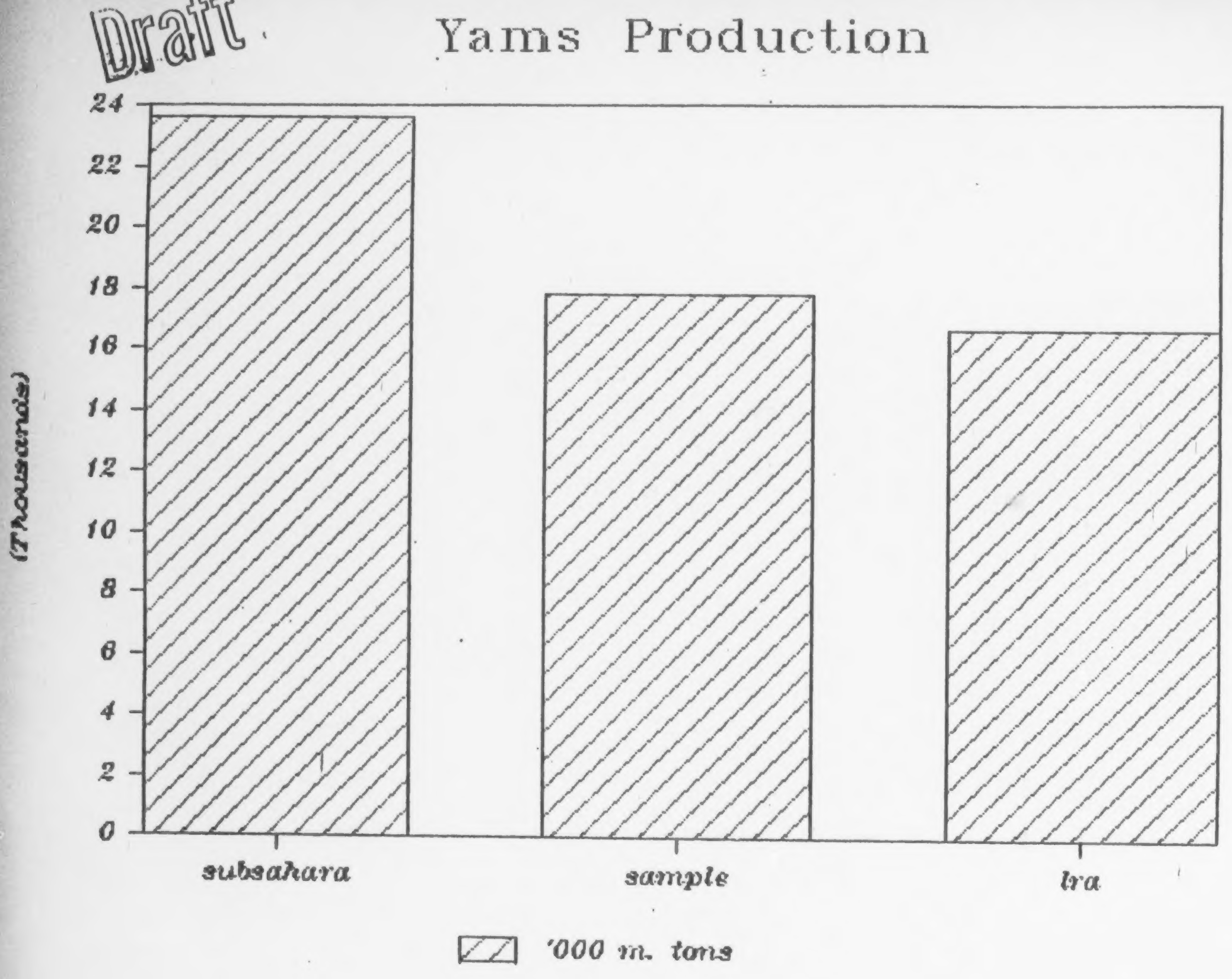
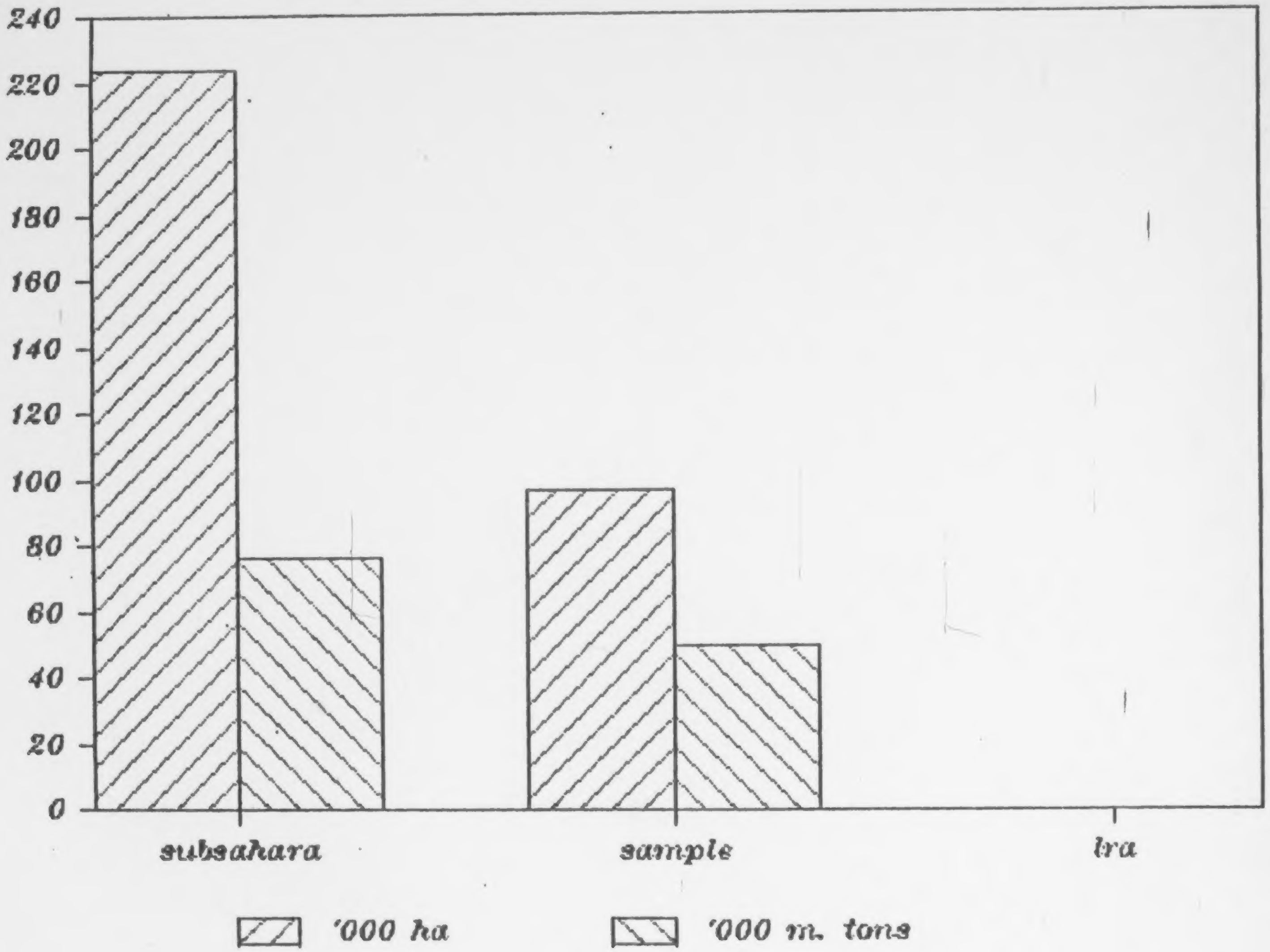

Yams Production
(Thousands)
24
22
20
18
16
14
12
10
8
6
4
2
0
subsahara
sample
tra
'000 m. tons

Draft

Sisal area and prod



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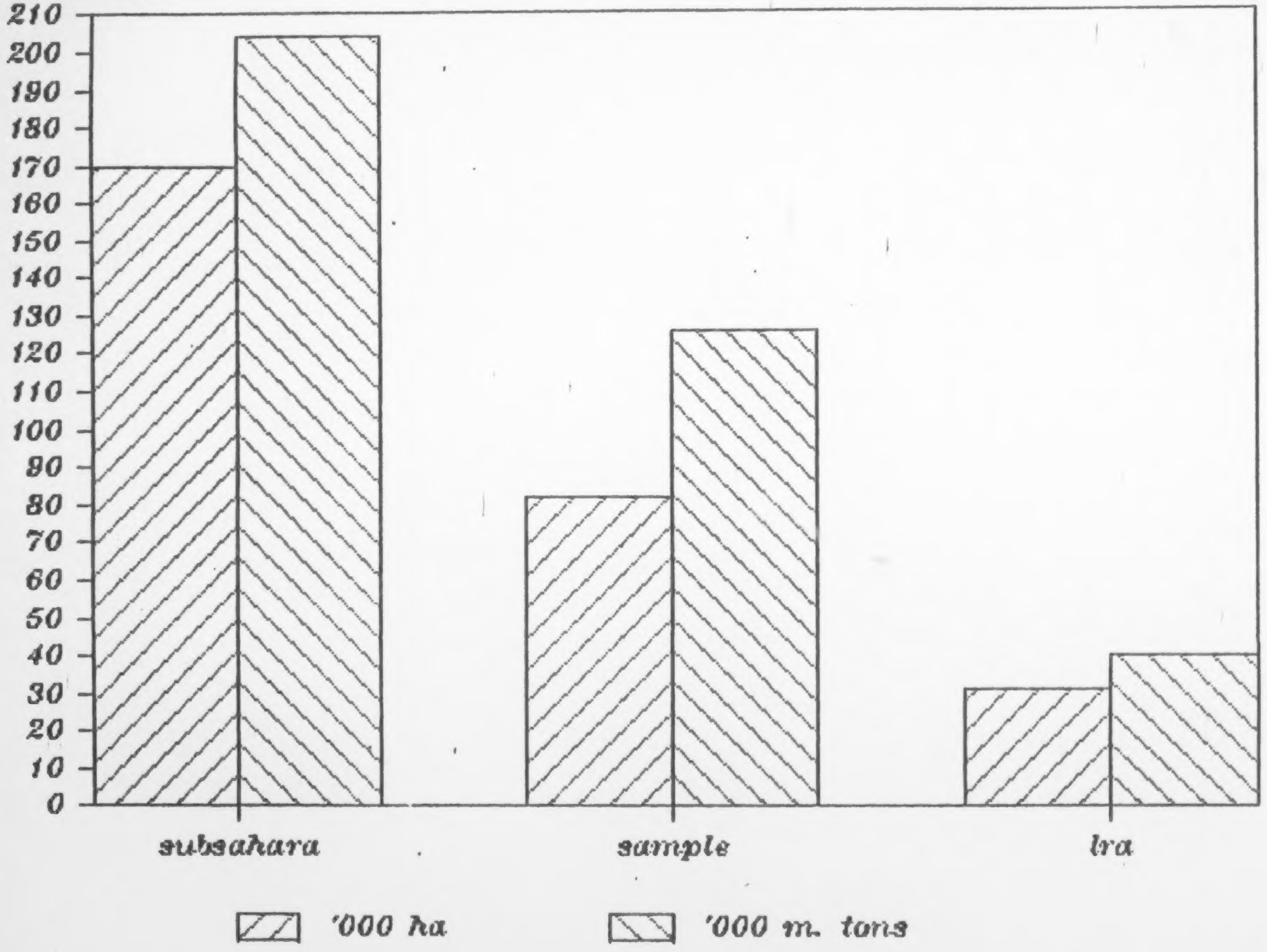
Tea Production



Contract Paper No. 4

DRAFT

The Role of Low-Resource Agriculture in Africa: Kenya Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW-RESOURCE AFRICAN AGRICULTURE

KENYA Supplementary Information

1. Production Statistics

a. Kenya's agriculture is diverse, both in its structure and in the types of commodities produced. The World Bank estimates that only about 7 percent of the total land area is high-quality land and another 15 percent is arable, while over 70 percent is suitable only for extensive use, mainly by livestock. Table 1 shows the distribution of holdings by type, which gives a breakdown between smallholders, irrigation schemes, and large commercial farms.

Detailed production data are also available for large farms in Kenya by province. Figure 1 is a map showing the provinces while Figure 2 shows the distribution of agroecological zones by province. Table 2 shows the distribution of land utilization for large farms by crop and province for 1982 and 1983. Total area of major crops and smallholder contribution by crop is seen in Table 3, while the location of smallholder production by crop is seen in Table 4.

b. In 1982, agriculture's share of GDP was 30 percent, while agriculture's share of foreign exchange earnings was 57 percent. Smallholders are major producers of export crops, supplying 64 percent of coffee and 40 percent of tea and almost 100 percent of cotton. Table 5 shows the distribution of Kenya's foreign exchange earnings by commodity for 1978-84

2. Producers

The only national survey that we are aware of which covers characteristics of producers is the series " Farm Management Handbook of Kenya". Vol. II of the Handbook gives results of field surveys for West Kenya, Central and East Kenya which were conducted in 1977. While the surveys are quite detailed and provide a wealth of information, it must be remembered that the data are nearly 10 years old , and furthermore there is no breakdown in labor use , income etc by gender. Some of the more salient data are shown for 1 district . Similar data could be made available for other districts and regions.

There are also numerous microlevel studies which are oriented towards determination of resource allocation and income levels at the farm level. An example of such a study would be L. Richard Meyer's paper

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on "A Sociological Approach to Farming Systems in Kenya" published by the Dept. of Rural Sociology, Cornell University in 1982. In the study located in Machakos District in Kenya, the author surveyed 174 households. Some of the findings from the survey were: a) over 22 percent of households reside permenently away from home, while 63 percent of households had at least 1 member residing away from home. The primary reason was employment and hence remittances become an important source of farm family income. The study did not report distribution of income by gender .

At the aggregate level results from the 1974-75 Integrated Rural survey, show the distribution of small farm population by Sex and Provice as shown below. The FAO survey quoted in the Senegal country writeup states that in 1970, in Kenya , 37.2 % of women were in the agricultural labor force, while 90.8% of women in the agricultural sector were economically active .

Census of small farm population by Sex and Provionce

Province	Male	Female
Central	1,148,139	1,141,742
Coast	260,189	301,506
Eastern	1,140,500	1,239,773
Nyanza	1,260,093	1,281,599
Rift Valley	337,176	337,109
Western	936,292	957,056

3. Method of Production

a. Irrigated/rainfed

While rainfed agriculture is predominant, irrigated agricultural schemes have been gradually increasing their area, although it is still minor compared with the overall area of rainfed production. Table 6 shows chamges in area of irrigated schemes.

b. Livestock/dairy/fish

Domestic livestock levels are estimated at 11.5 million cattle, 8.3 million goats, and 4.3 million sheep. About 50 percent are raised in intensive operations, while the rest are raised in extensive range areas. Due to reoccurrence of drought, Kenya's livestock population has been fluctuating. Livestock are an important part of the economy, contributing 5 percent of GDP and 10 percent of exports. The changing levels of livestock on large farms for the period 1975-1983 is shown in Table 7. Dairy production for 1973-1983 is shown in Table 8 _.

Fish is also important in Kenya as a source of nutrition. The quantity and value of fish landed for the period 1977-1984 is shown in Table 9_.

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c. Types and amounts of commercial inputs

Tables 10-11 show the value of different types of agricultural inputs purchased by crop and livestock farmers for 1977-1983. Corresponding data on quantities of inputs utilized by similar category are not available. Use of commercial inputs is not restricted to large farms. Small-scale farms have increased area planted to improved maize to the extent that 50 percent of smallholders in the country now grow hybrid maize, but nearly 86 percent also grow local varieties. Fertilizer use has increased smallholder maize yields from 1.5 tons/ha to 3.0 tons/ha.

d. Intercropping/monocropping

While crops like tea, coffee, sugarcane, rice are monocropped, various combinations of intercrops exist especially among smallholders. Sorghum and millet are intercropped in the semi-arid areas, while maize is interplanted with beans in the highlands.

4. Consumption and storage

Due to drought in recent years, Kenya's importation of food has fluctuated. Wheat and rice are cereals in which Kenya is not self-sufficient. The supply and utilization of cereals in Kenya for recent years is shown in Tables12-14.

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Table 1

KENYA
Land Area and Use

	Area ('000 ha)	% of Total Area Farmed a/	Approximate Average Holding Size (ha)	Total Number
Distribution of Holdings (1976-79)				
Smallholdings (20 ha)	3,500.0	56.1	2.0	1,704,00
Irrigation Schemes	8.7	0.1	1.6	4,74
Gap Farms (20-50 ha)	1,000.0	16.0	25	40,00
Intact Large Mixed Farms (20 ha)	585.0	9.4	n.a.	n.a.
Subdivided Mixed Farms	315.0	5.0	n.a.	n.a.
Plantations (cropped area only)	185.0	3.0	390	129
Commercial Ranches	650.0	10.4	6,500	100
Subtotal	6,243.7	100		

a/ Includes commercial ranches.
b/ Mostly intercropped with cereals.
c/ Excludes commercial ranches.

Sources: (1) Livingstone, Rural Employment and Incomes in Kenya, ILO (1981)
(2) Statistical Abstracts and Economic Surveys, various years.

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FIGURE 1: KENYA - PROVINCES

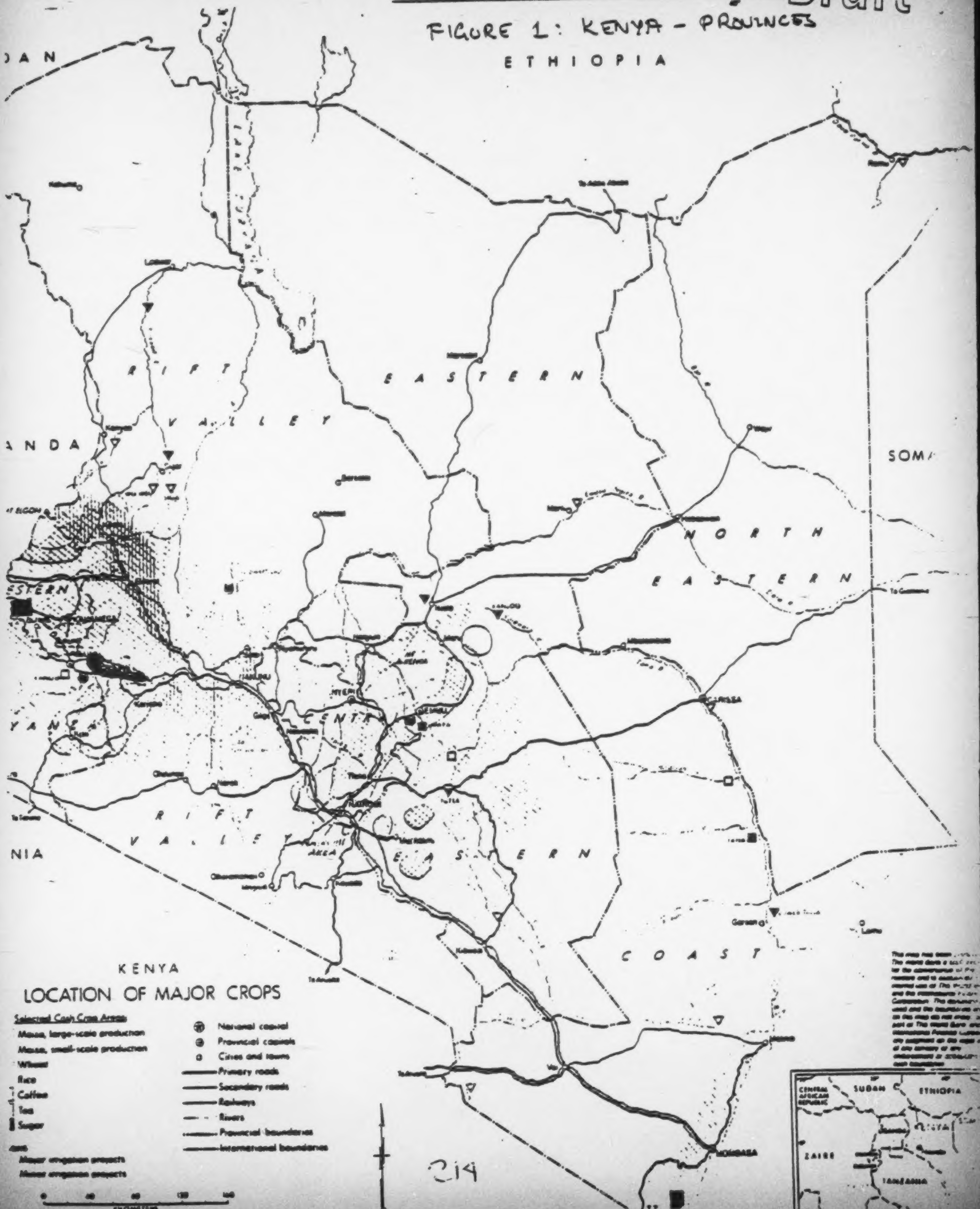
ETHIOPIA
DAN
ANDA
SOMA
NIA
RIFT VALLEY
EASTERN
NORTH EASTERN
ESTERN
YANZA
CENTR
RIFT VALLEY
EASTERN
COAST
MT ELGON
NYERI
GARISSA
Garsen
Lamu
Voi
MOMBASA
SUDAN
ETHIOPIA
CENTRAL AFRICAN REPUBLIC
ZAIRE
TANZANIA
KENYA
LOCATION OF MAJOR CROPS
Selected Cash Crop Areas
Maize, large-scale production
Maize, small-scale production
Wheat
Rice
Coffee
Tea
Sugar
Major irrigation projects
Minor irrigation projects
National capital
Provincial capitals
Cities and towns
Primary roads
Secondary roads
Railways
Rivers
Provincial boundaries
International boundaries
0
40
80
120
160
KILOMETERS

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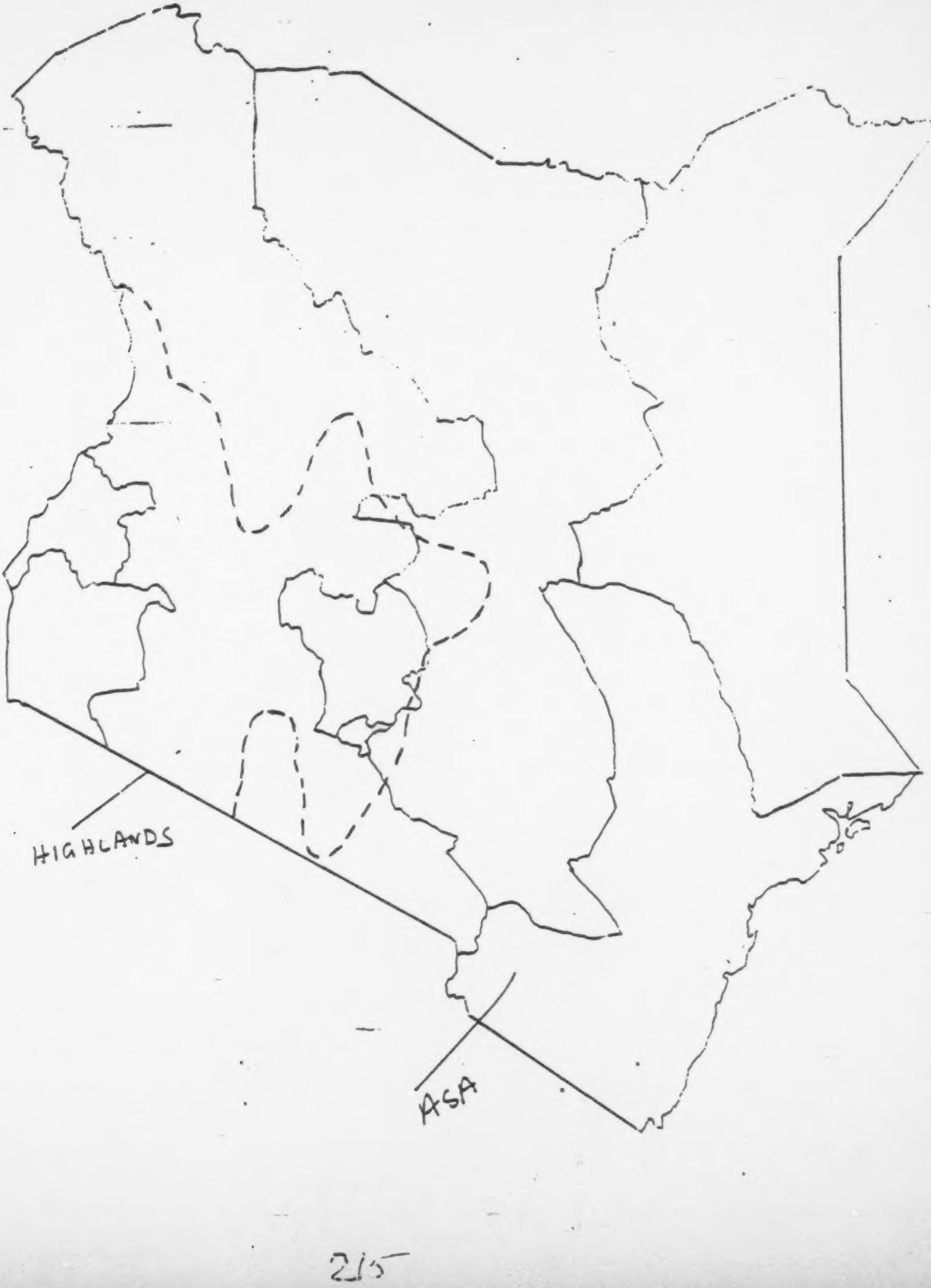
FIGURE 2:- KENYA AGROECOLOGICAL ZONES ACROSS PROVINCES.


HIGHLANDS
ASA

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AGRICULTURE TABLE 2: LARGE FARMS : KENYA

Land Utilisation by District, 1983

[illegible]

Hectares

	Nyanza Province			Rift Valley Province							
	Kisumu	Kisii	Total	Baringo	Kericho	Trans-Nzoia	Laikipia	Nakuru	Nandi	Uasin Gishu	Total
Cereals											
Wheat	—	205	205	—	1,185	6,852	731	21,592	—	35,379	65,739
Maize	116	350	466	6	4,882	33,573	4,663	14,102	1,215	20,042	78,483
Barley	—	—	—	—	48	23	237	5,589	—	1,259	7,156
Oats	—	—	—	—	60	24	51	1,815	—	389	2,339
Others	47	8	55	9	293	205	17	784	—	143	1,451
Total	163	563	726	15	6,468	40,677	5,699	43,882	1,215	57,212	155,168
Temporary Industrial Crops											
Sugarcane	13,572	2,623	16,195	—	845	557	—	1	10,645	59	12,107
Pyrethrum	—	6	6	4	145	2	6	2,547	3	1,112	3,819
Sunflower	—	—	—	—	7	1,528	26	317	—	184	2,062
Others	—	—	—	—	—	8	—	71	—	8	57
Total	13,572	2,629	16,201	4	997	2,095	32	2,936	10,648	1,363	18,075
Root Crops and Vegetables	37	11	48	—	291	1,999	938	2,039	120	835	6,222
Temporary Fodder Crops ..	3	1	4	4	65	1,073	121	2,798	48	224	4,333
Other Temporary Crops	1	—	1	—	311	406	22	6,905	—	192	7,836
Temporary Meadows and Fallow Land	5,760	1,456	7,216	2,160	47,410	84,636	369,732	272,069	23,811	125,840	925,358
Permanent Industrial Crops											
Sisal	—	—	—	—	—	—	—	25,259	—	308	~~25,567~~
Tea	1	1,350	1,351	—	12,916	29	430	393	6,835	2,134	22,742
Coffee	4	—	4	—	394	756	3	2,445	71	5	4,174
Wattle	—	6	6	—	34	56	—	57	55	14,881	15,083
Coconut ..	—	—	—	—	—	—	—	—	-	—	—
Others	—	—	—	—	531	28	—	105	97	34	795
Total	5	1,356	1,361	-	14,372	969	433	28,259	7,058	17,367	68,361
Fruit											
Cashew nuts	—	—	—	—	—	—	—		-	—	
Pineapples	10	-	10	—	—	1	—			—	1
Others	23	...	23	2	28	257	15	272	6	100	680
Total	33	-	33	2	28	258	15	275	6	100	681
Uncultivated Meadows and Pastures	6,303	4,877	11,180	7,155	61,191	112,434	642,601	344,713	27,090	180,888	1,384,062
All Land	25,877	10,893	36,770	9,340	131,123	244,147	1,019,593	703,876	69,996	392,021	2,570,096

	Western Province			Central Province				
	Bungoma	Kakamega	Total	Kiambu	Nyandarua	Nyeri	Murang'a	Total
Cereals								
Wheat	—	—	—	85	2,002	570	1	2,658
Maize	76	9	85	208	380	160	542	1,290
Barley	—	—	—	—	455	—	1	456
Oats	—	—	—	1	73	30	—	104
Others	—	—	—	4	72	34	5	115
Total	76	9	85	298	2,982	794	549	4,623
Temporary Industrial Crops								
Sugarcane	3,079	3,711	6,789	—	—	—	-	-
Pyrethrum	—	—	—	1	164	—	—	164
Sunflower	—	—	—	6	—	—	—	6
Others	—	—	—	—	5	—	—	5
Total	3,078	3,711	6,789	7	173	—	-	185
Root Crops and Vegetables	..	..	-	177	321	117	230	845
Temporary Fodder Crops .	..	..	-	354	65	145	23	587
Other Temporary Crops	—	—	—	877	3	958	1,434	3,272
Temporary Meadows and Fallow Land	1,375	3,058	4,433	35,134	51,326	30,591	21,370	148,421
Permanent Industrial Crops								
Sisal ..	—	—	—	2,521	—	—	6,020	8,551
Tea ..	—	—	—	3,547	—	—	—	3,547
Coffee ..	6	—	6	12,979	4	1,428	6,350	20,761
Wattle	—	—	—	116	44	76	—	236
Coconut	—	—	—	—	—	—	—	—
Others ..	—	—	—	135	—	90	129	354
Total ..	6	—	6	19,298	48	1,594	12,509	33,449
Fruit								
Cashewnuts ..	—	—	—	—	—	—	—	—
Pineapples ..	—	—	—	5,243	—	2	15	5,260
Others ..	—	—	—	312	133	1	162	608
Total ..	—	—	—	5,555	133	3	177	5,868
Uncultivated Meadows and Pastures	1,556	3,059	4,615	48,731	83,455	38,055	38,532	208,773
All Land	6,091	9,837	15,928	110,431	148,506	72,257	74,831	406,023

Uasin Gishu	Tota
35,379	65,739
20,042	78,483
1,259	7,156
384	2,339
143	1,451
57,212	155,168
59	12,107
1,112	3,819
184	2,062
8	87
1,363	18,075
835	6,222
224	4,333
192	7,836
125,840	925,358
308	25,567
2,139	22,742
5	4,174
14,891	15,083
—	—
34	795
17,367	68,361
100	681
100	681
180,888	1,384,062
392,021	2,570,096

Murang'a	Total
1	2,658
542	1,290
1	456
—	104
5	115
549	4,623
7	7
—	169
—	6
—	5
7	185
230	845
23	587
1,434	3,272
21,370	148,421
6,020	8,551
—	3,547
6,350	20,761
—	236
—	—
129	354
12,509	33,449
—	—
15	5,260
162	609
177	5,868
38,532	208,773
74,831	406,023

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~~Table 85 (Continued)~~

LARGE FARMS

Land Utilisation by District, 1982**

	EASTERN PROVINCE			COAST PROVINCE				NAIROBI	TOTA (All Provin
	Machakos	Meru	Total	Kilifi	Kwale	Taita	Total		
Cereals									
Wheat	3	4,556	4,559	—	—	—	—	—	73,161
Maize	532	31	563	6	—	—	6	29	10,92
Barley	—	1,041	1,041	—	—	—	—	—	8,65
Oats	—	65	65	—	—	—	—	—	2,50
Others	12	1	13	—	—	—	—	1	1,6
Total	547	5,694	6,241	6	—	—	6	30	166,37
Temporary Industrial Crops									
Sugarcane	—	—	—	6	5,759	—	5,765	—	40,46
Pyrethrum	—	1	1	—	—	—	—	—	3,9
Sunflower	7	—	7	—	—	—	—	22	2,0
Others	—	—	—	—	—	—	—	—	5
Total	7	1	8	6	5,759	—	5,765	22	47,0
Root Crops and Vegetables	199	1	200	132	—	135	267	186	7,7
Temporary Fodder Crops	—	160	160	6	2	—	8	15	5,1
Other Temporary Crops	77	3,641	3,641	14	—	—	14	10	14,
Temporary Meadows									
Permanent Industrial Crops	132,682	29,700	162,382	11,710	3,533	23,665	38,908	17,932	1,304,
Sisal	6,524	—	6,524	5,419	—	50,143	55,562	706	96,
Tea	—	—	—	—	—	—	—	—	[illegible]
Coffee	3,159	—	3,159	25	83	282	390	924	29,
Wattle	—	—	—	—	—	—	—	—	15,
Coconut	—	—	—	219	978	—	1,269	—	1
Others	—		—	66	447	—	513	1	1,66
Total	9,683		9,683	5,801	1,508	50,425	57,734	1,631	172,225
Fruit									
Cashewnuts				963	578	-	1,541		1,54
Pineapples				—			—		5,2
Others ..	[illegible]	[illegible]	15	323	35	-	358	40	1,74
Total ..	27	8	35	1,286	613	-	1,899	40	8,55
Uncultivated Meadows and Pastures	216,330	29,452	245,782	13,796	3,880	23,665	41,341	25,668	1,921,42
All Land ..	359,952	68,590	428,132	32,757	15,295	97,890	145,942	45,534	3,648,4

Source: Central Bureau of Statistics.

*The difference between the total shown in this table and the one shown in table 83 is on the account of "Forest Land" which is included in this table.

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LARGE FARMS

Land Utilization by Districts, 1983**

~~[illegible]~~

Hectares

	Nyanza Province			Rift Valley Province							
	Kisumu	Kisii	Total	Baringo	Kericho	Trans-Nzoia	Laikipia	Nakuru	Nandi	Uasin Gishu	Total
Cereals											
Wheat	—	—	—	—	1,285	7,196	1,158	22,779	7	35,105	67,530
Maize	122	330	452	—	3,838	29,544	4,903	9,835	696	25,216	74,039
Barley	—	—	—	—	—	—	72	4,945	—	24	5,041
Oats	—	—	—	—	55	60	92	1,341	—	553	2,101
Others	93	—	93	9	479	186	30	295	—	228	1,227
Total	215	330	545	16	5,657	36,986	6,255	39,195	702	61,126	149,938
Temporary Industrial Crops											
Sugarcane	13,465	2,621	16,086	—	636	1	—	—	7,579	142	8,358
Pyrethrum	—	5	5	2	143	3	18	1,676	3	562	2,407
Sunflower	—	—	—	—	—	1,638	18	1,077	116	262	3,111
Others	—	—	—	—	—	—	—	—	—	—	—
Total	13,465	2,626	16,091	2	779	1,642	36	2,753	7,698	966	13,876
Root Crops and Vegetables ..	1	—	1	6	530	1,088	1,401	1,925	24	1,094	6,068
Temporary Fodder Crops ..	1	1	1	—	35	692	40	3,910	31	210	4,918
Other Temporary Crops ..	—	—	—	—	—	564	40	7,776	1	31	8,412
Temporary Meadows and Fallow Land	6,345	1,254	7,599	2,153	47,232	114,092	312,700	233,298	30,627	139,819	878,921
Permanent Industrial Crops											
Sisal	—	—	—	—	—	—	—	24,011	974	—	24,985
Tea	1	1,287	1,288	—	12,829	10	337	524	7,253	1,498	22,451
Coffee	2	—	2	—	1,033	1,066	162	3,056	63	12,545	17,925
Wattle	—	6	6	—	—	38	—	112	65	9,335	9,550
Coconut	—	—	—	—	—	—	—	—	—	—	—
Others	—	—	—	—	575	160	—	4,087	91	12,578	17,491
Total	3	1,293	1,296	—	14,437	1,274	499	31,790	8,446	35,956	92,402
Fruit											
Cashewnuts	—	—	—	—	—	—	—	—	—	—	—
Pineapples	4	—	4	—	—	—	—	—	—	—	—
Others	34	—	34	2	90	340	12	325	33	62	864
Total	38	—	38	2	90	340	12	325	33	62	864
Uncultivated Meadows and Pastures	6,656	4,118	10,774	2,816	58,319	117,346	632,879	330,914	33,487	186,585	1,362,346
All Land	26,724	9,622	36,345	4,996	127,079	274,024	953,863	651,286	81,049	425,849	2,518,745

	Western Province			Central Province				
	Bungoma	Kakamega	Total	Kiambu	Nyandarua	Nyeri	Murang'a	Total
Cereals								
Wheat	—	—	—	—	2,464	744	1	3,209
Maize	93	9	102	149	2,166	431	50	2,795
Barley	—	—	—	—	488	—	1	489
Oats	—	—	—	—	76	—	—	76
Others	—	—	—	2	269	26	3	300
Total	93	9	102	151	5,463	1,201	55	6,870
Temporary Industrial Crops								
Sugarcane	4,952	3,751	8,703	—	—	—	18	18
Pyrethrum	—	—	—	—	166	—	—	166
Sunflower	1	—	1	37	—		—	37
Others	—	—	—	—	5	—	—	5
Total	4,953	3,751	8 704	37	171	—	18	226
Root Crops and Vegetables ..	13	2	15	78	346	143	114	681
Temporary Fodder Crops	—	—	—	343	83	164	84	674
Other Temporary Crops	—	—	—	1 051	3	1,836	131	3,021
Temporary Meadows and Fallow Land	1,053	796	1,849	48,179	45,007	29,869	25,801	148,856
Permanent Industrial Crops								
Sisal	—	—	—	6,618	—	—	4,063	10,681
Tea	—	—	—	3,438	—	—	—	3,438
Coffee	1	—	1	14,313	471	2,478	7,001	24,263
Wattle	—	—	—	148	—	168	217	533
Coconut	—	—	—	—	—	—	—	—
Others	1	—	1	6,451	3	140	442	7,036
Total	2	—	2	30,968	474	2,786	11 723	45,951
Fruit								
Cashewnuts	—	—	—	—	—	—	—	—
Pineapples	—	—	—	6,224	—	4	67	6,295
Others	—	—	—	263	18	20	101	402
Total	—	—	—	6,487	18	24	168	6,697
Uncultivated Meadows and Pastures	1,228	814	2,042	64,441	69,876	35,565	29,120	199,082
All Land	7,342	5,372	12,714	151,736	121,441	71,588	67,214	411,978

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LARGE FARMS

Land Utilization by Districts, 1983**

~~Table [illegible] (Contd.)~~

Hecta

	Eastern Province			Coast Province				Nairobi	Total (All Prov
	Machakos	Meru	Total	Kilifi	Kwale	Taita	Total		
Cereals									
Wheat	3	5,758	5,761	—	—	—	—	—	76,
Maize	480	24	504	60	—	—	60	15	77,967
Barley	—	1,202	1,202	—	—	—	—	—	6,732
Oats	12	176	188	—	—	—	—	2	2,367
Others	124	—	124	—	—	—	—	—	1,74
Total	619	7,160	7,779	60	—	—	60	17	165,
Temporary Industrial Crops									
Sugarcane	—	—	—	—	5,650	—	5,650	—	38,9
Pyrethrum	—	1	1	—	—	—	—	—	2,5
Sunflower	15	—	15	—	4	—	4	—	3,16
Others	—	—	—	—	—	—	—	208	21
Total	15	1	16	—	5,654	—	5,654	208	44,
Root Crops and Vegetables	136	27	163	115	—	—	115	46	7,
Temporary Fodder Crops	—	437	437	145	5	—	150	33	6,
Other Temporary Crops	260	52	312	—	—	—	—	11	11,7
Temporary Meadows and Fallow Land	122,005	32,285	159,290	2,796	3,979	—	6,775	11,055	1,215,
Permanent Industrial Crops									
Sisal	5,831	—	5,831	5,799	—	38,829	44,628	762	86,
Tea	—	—	—	—	—	—	—	—	27,
Coffee	3,629	—	3,629	—	139	—	139	1,189	47,
Wattle	2	—	2	—	—	—	—	—	10,
Coconut	—	—	—	284	1,053	—	1,337	—	1,
Others	1	—	1	—	195	—	195	127	24,
Total	9,463		9,463	6,083	1,387	38,829	46,299	2,078	197,
Cashewnuts	—	—	—	1.063	575	—	1,638	—	1,638
Pineapples	—		—	—	—	—	—	—	6.299
Others	15	12	27	349	13		363	14	1,70
Total	15	12	27	1,412	588		2.000	14	9,64
Uncultivated Meadows and Pastures	239,935	29,053	268,988	10,000	4,009	—	14,009	24.292	1,881,45
All Land	377,448	69.027	446.475	20,611	15.622	38,829	75,062	37.754	3,539,07

Source: Central Bureau of Statistics.

*The difference between the total shown in this table and the one shown in Table 83 is on account of "Forest Land" which is not include in this Table.

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TABLE 3. Total Area of Major Crops and Production on all Farms and Smallholder Contribution

	Area ('000 ha)				Production ('000 tons)					
Crops	1969-71	1978	1979	1980 f/	1969-71	1978	1979	1980 f/	Percentage of Smallholders Growing Crop	Smallholder Contribution to Marketed Production (%)
Maize	1,383	1,490	1,400	1,500	2,060	2,169	1,800	1,900	86	43
Wheat	133	119	117	122	223	175	207	210	0.1	n.a.
Rice paddy	6	7	7	7	27	42	43	40	0.3	100
Pulses (total)	565	600 e/	550 e/	550	267	274	234	240	69 (beans)	100
Sugarcane	26	31	34	40	1,645	2,819 e/	4,034 e/	4,474	n.a.	45
Pyrethrum	—	—	—	—	—	—	—	—	9	95
Cotton (lint)	74	126	90	140	16	27	28	38	9	100
Coffee (green beans)	85	122	119	125	57	84	75	91	27	60
Tea (made tea)	30	55	59	62	38	93	99	90	12	36
Total crops	2,070	2,170 e/	2,270	2,270	—	—	—	—	—	—

f = forecast
e = estimate
n.a. = not available

SOURCE: 1. Area and Production Data: FAO Production Year Book (1980)
2. Data on Smallholders: Statistical Abstract (1981)/Economic Survey (1982) and Integrated Rural Survey 1974-75.

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VOLUME II
STATISTICAL APPENDIX
Table 4.18

TABLE 4: Smallholder Crop and Milk Production in the Farming Year 1978/79

Crop or Product	Total (000 tonnes)	Main Producing Provinces
Maize	1,541.7	Rift Valley, Central, Nyanza, Eastern, Western.
Millet and Sorghum	166.5	Nyanza.
Other Cereals	120.6	
Beans	573.3	Central, Eastern.
Peas	106.5	
Goundnuts	135.9	Nyanza, Eastern.
Other nuts	218.7	Coast, Rift Valley.
Potatoes	810.0	Central, Rift Valley.
Sweet potatoes	197.0	Central, Western, Nyanza.
Cassava	230.4	Nyanza, Western.
Other root crops	61.2	
Bananas	186.4	Western.
Other fruits	111.6	Coast, Nyanza.
Vegetables	442.8	All areas.
Oilseeds	117.9	Western.
Sugarcane	66.6	Nyanza.
Pyrethrum (dried)	2.7	Rift Valley, Central, Nyanza.
Cotton	24.0	Central, Coast, Eastern, Nyanza.
Other temporary crops	117.0	
Coffee (clean)	423.9	Central, Eastern, Nyanza.
Tea	380.7	Central, Rift Valley, Nyanza.
Cashew nuts	15.3	Coast, Western.
Coconuts	72.0	Coast.
Other permanent crops	70.2	
Milk (million litres)	769.0	Rift Valley, Central.

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TABLE 5

Value of Agricultural Exports
(K£ million)

14.41

	1978	1979	1980	1981	1982	1983	1984
Coffee	125	111	108	109	145	160	204
Tea	63	63	58	61	78	123	190 $264.
Others		75	80	94	89	122	124
Fruits & Vegetables	20	22	25	32	28	55	54
of which							
Fresh Horticultural Produce	8	10	11	13	14	18	18
Tinned Pineapples	10	9	9	12	15	21	26
Hides & Skins	10	14	10	9	8	6	7
Sisal	4	5	9	9	11	12	13
Pyrethrum Extract	4	6	9	6	9	9	10
Meat Products	3	3	2	3	5	4	7
Sugar and Products	n.a.	4	13	20	4	2	2
Cotton (raw)	2	1	3	2	-	1	-
Wool (raw)	1	1	1	1	1	1	1
Animal Feeds	1	1	-	-	1	2	1
Live Animals ('000)	-	-	1	2	2	4	4
Total Agricultural Exports	251	249	246	264	312	405	518 = $714
Petroleum Products	69.0	77.2	162.5	163.7	149.4	134.4	142.2
Other Non-Agricultural	50.0	59.3	79.1	86.2	84.3	93.7	94.6
Total Exports	370.0	385.5	487.6	513.9	545.7	633.1	754.8
% of Agriculture in Total	67.8	64.6	50.5	51.4	57.2	64.0	68.6
% of Coffee & Tea in Total	50.8	45.1	34.0	33.1	40.9	44.7	52.2

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VOLUME II
STATISTICAL APPEND
Table 4.7

KENYA-OTA

TABLE 6. PROGRESS AND PRODUCTION AT SEVEN IRRIGATION SCHEMES AREAS

ITEM	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84*
MWEA								
AREA CROPPED (HECTARES)	5616	5648	5767	5767	5771	5782	5784	5820
PLOT-HOLDERS (NUMBER)	2973	3003	3149	3150	3150	3150	3151	3173
GROSS VALUE OF OUTPUT (KENYA POUNDS '000)	2088	2054	1926	1637	2029	2331	3563	4213
PAYMENTS TO PLOT-HOLDERS (KENYA POUNDS '000)	1083	1566	1416	1412	1425	1746	1788	2198
ALL (7) SCHEMES AREAS								
AREA CROPPED (HECTARES)	8728	8607	9296	9538	9753	9417	9900	9518
PLOT-HOLDERS (NUMBER)	4744	4909	5283	5553	5735	5669	6115	6361
GROSS VALUE OF OUTPUT (KENYA POUNDS '000)	2880	2659	2779	2496	3267	4715	5150	6056
PAYMENTS TO PLOT-HOLDERS (KENYA POUNDS '000)	1553	1825	1659	1870	1896	2314	2495	2858
CROPS PRODUCED (TONS)								
MWEA (PADDY)	35960	32289	29046	29202	31041	29848	28751	29336
AHERO (PADDY)	5127	3985	3539	4106	4326	3969	3388	3324
W. KANO (PADDY)	1477	1009	2146	3379	3583	3519	2935	2302
W. KANO (SUGARCANE)	-	-	-	-	11395	11871	5715	5594
BUNYALA (PADDY)	1074	756	681	789	995	1283	1338	1293
TANA (COTTON	2507	1309	1382	1242	2337	1684	1478	1559
PERKERRA (ONIONS)	1083	418	577	1127	1256	834	967	975
PERKERRA (CHILIES)	172	132	165	503	244	139	45	94
BURA (COTTON)	-	-	-	-	-	-	1633	1482

SOURCE: REPUBLIC OF KENYA, ECONOMIC SURVEYS

*PROVISIONAL DATA

DECEMBER 31, 1985

TABLE 7

Draft

LARGE FARMS

Livestock Numbers, 1975–1983

Table 86

'000 Head

	1975	1976	1977	1978	1979	1980	1981	1982	1983**
Dairy									
Cows	176·5	175·0	172·6	172·2	180·4	166·4	167·8	165·0	167·9
Heifers	95·3	95·9	88·5	88·2	90·2	86·2	83·3	89·7	90·0
Bulls and bull calves*	14·7	19·2	25·2	22·9	24·4	23·8	26·0	24·0	44·0
Total	286·5	290·1	286·3	283·3	295·0	276·4	277·1	278·7	301.9
Beef Cattle									
Cows	138·2	150·3	138·2	142·3	139·8	141·1	124·3	120·1	123·6
Bulls and bull calves Other	313·2	306·3	302·1	289·0	272·0	290·4	299·8	283·7	258·9
Total	451·4	456·6	440·3	421·3	411·8	431·5	424·1	403·8	382.5
Sheep	346·4	325·9	295·7	296·8	321·7	306·2	330·0	354·4	355·2
Pigs	20·2	17·9	15·8	17·3	19·7	18·3	15·4	8·7	4·5
Poultry	285·8	253·6	363·6	250·2	304·1	219·5	124·2	336·0	259·6

Source: Central Bureau of Statistics.

*Maintained for stud purposes only.

**Provisional.

LARGE FARMS

Capital Expenditure, 1975–1983

(Net of Sales)

Table 87

K£'000

Type of Capital Expenditure	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Residential buildings	2,828·3	3,373·5	3,737·5	5,260·8	5,399·2	6,109·8	6,492·3	7,780·8	7,717·6
Non-residential buildings	1,877·8	694·0	1,117·0	2,157·1	3,578·1	4,947·1	4,183·4	3,726·3	8.390·7
Mechanical equipment	3,992·9	3,823·9	5,725·5	8,906·9	9,068·1	11,167·7	14,796·7	9,710·6	9.584·8
Roads, dams and water supplies	1,208·0	914·3	1,553·0	1,489·1	1,822·3	1,853·2	2,502·0	2,218·0	2,487·0
Fencing	141·8	559·8	627·0	554·4	545·4	608·0	820·1	1,004·3	1,347·4
Plantation development	1,568·3	1,581·3	2,058·4	2,487·0	2,506·5	2,568·7	452·8	2,987·9	6,327·9
Other Construction	636·3	464·0	622·5	1,319·1	1,163·2	706·1	1,080·8	2,466·0	2,478·0
Total	12,253·3	11,409·8	15,441·0	22,174·4	24,082·8	27,960·6	30,328·1	29,893·9	55,333·4

Source: Central Bureau of Statistics.

*Provisional.

LARGE FARMS

Mechanical Equipment, 1975–1983

Table 88

Numbers

	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Tractors									
Wheel	5,501	5,503	5,728	6,013	6,008	6,180	6,075	6,322	9,049
Crawler	512	479	458	436	366	366	324	332	370
Combined Harvesters									
Self-propelled	289	322	260	251	270	302	205	193	237
Tractor drawn	144	147	119	113	125	111	100	106	310

Source: Central Bureau of Statistics.

*Provisional.

KENYA-OTA
TABLE 8

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VOLUME II
STATISTICAL APPENDIX
Table 4.9

DAIRY

KENYA: DAIRY PRODUCTION - 1973-1983 _1/

ITEM	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
MILK PRODUCTION('000 LTR)_2/	279658	249843	230607	208658	259450	269796	240559	186805	222895	260336	274162
WHOLEMILK AND CREAM('000 LTR) 3/	148816	160009	157956	150422	157880	185557	212255	186892	222335	235549	315221
BUTTER AND GHEE (TONS)	5543	4366	4191	3067	4342	3871	3134	2174	2729	3160	3721
CHEESE (TONS)	988	558	462	177	445	253	264	150	210	157	227
EVAPORATED MILK (TONS)	5129	3249	1626	2099	1321	489	108	44	-	-	-
DRIED WHOLEMILK POWDER (TONS)	3697	2592	2289	3009	5262	4236	1439	128	1334	2350	1693
DRIED SKIMMILK POWDER (TONS)	3014	3019	2772	1489	3440	2956	1218	80	469	1715	1921
OTHER PRODUCTS (TONS)	159	71	1	2	1	-	-	270	131	71	-

SOURCE: CENTRAL BUREAU OF STATISTICS, STATISTICAL ABSTRACTS.

_1/ ALL PRODUCTS ARE FROM MILK PROCESSED BY KCC
_2/ DELIVERIES OF MILK AND BUTTERFAT TO KENYA CO-OPERATIVE CREAMERIES AND OTHER SALES LICENSED BY THE KENYA DAIRY BOARD
_3/ WHOLEMILK EQUIVALENT

DECEMBER 31, 1985

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FISH -KENYA - OTA

QUANTITY AND VALUE OF FISH LANDED - 1977-1984

ITEM	1977	1978	1979	1980	1981	1982	1983	1984*
QUANTITY (TONS)								
FRESHWATER FISH								
LAKE VICTORIA	19332	23856	30592	26914	38179	60958	77327	59500
LAKE TURKANA	15473	15560	13731	12384	10529	11040	10113	10008
OTHER AREAS	1820	2344	2075	3584	2677	2019	3628	3916
TOTAL	36625	41760	46398	42882	51385	74017	91068	73424
MARINE FISH								
FISH	4046	4178	2858	4905	5546	6622	5798	3910
CRUSTACEANS	205	365	256	400	384	426	474	248
OTHER MARINE PRODUCTS	82	19	801	31	37	68	121	860
GRAND TOTAL	40961	46322	50313	48218	57352	81133	97461	78442
VALUE (KENYA POUNDS '000)								
FRESHWATER FISH	2020	3282	3708	3960	6363	8477	8329	6945
MARINE FISH	679	796	625	1156	1487	2055	2063	1405
CRUSTACEANS	103	216	184	342	338	413	539	273
OTHER MARINE PRODUCTS	58	47	139	9	14	80	204	345
TOTAL	2860	4341	4656	5467	8202	11025	11135	8968

SOURCE: REPUBLIC OF KENYA, ECONOMIC SURVEYS

*PROVISIONAL DATA

DECEMBER 31, 1985

KENYA - OTA ..

Draft

TABLE 10

~~Table 80~~

AGRICULTURAL INPUTS, 1977-1983

K£'000

	1977	1978	1979	1980	1981	1982*	1983*
Material Inputs							
Fertilizers	13,765	14,781	12,678	13,692	14,787	14,685	14,341
Other agricultural chemicals**	7,197	10,626	8,494	9,858	11,902	12,273	11,910
Livestock drugs and medicines**	3,261	3,306	3,196	4,599	5,053	5,804	5,335
Fuel	7,667	8,509	9,749	10,835	12,775	11,523	10,619
Power	2,001	2,253	3,076	3,891	3,200	2,989	2,909
Spares and maintenance of machinery ..	1,572	1,872	2,033	2,305	2,396	2,620	2,725
Bags	3,331	3,636	3,469	3,704	5,548	5,851	6,358
Manufactured feeds**	9,193	12,154	8,872	9,492	13,753	10,529	9,778
Seeds	4,370	4,522	3,732	3,733	5,258	5,156	5,640
Office expenses	165	172	178	187	194	212	225
Small implements	761	652	838	915	945	759	695
Other	931	750	721	815	630	1,069	1,236
Total	**54,214**	**63,233**	**57,036**	**64,026**	**76,441**	**73,470**	**76,771**
Services Inputs							
Marketing, research and publicity ..	2,360	2,828	3,180	2,624	2,703	2,919	3,065
Artificial insemination	16	15	17	17	17	18	19
Aerial spraying	118	119	118	120	124	130	135
Accounting, secretarial and auditing services	831	913	1,003	1,117	1,231	1,427	1,445
Tractor services	1,384	1,699	1,981	2,363	2,435	2,523	2,611
Private veterinary services	30	30	30	30	31	33	35
Government seed inspection services ..	30	38	48	46	47	48	48
Farm planning and survey services ..	3	3	1	1	1	1	2
Government veterinary inoculation services	44	51	29	31	32	32	35
Insurance	345	393	450	477	491	509	527
Transportation	920	1,034	1,072	1,583	2,340	2,771	3,048
Other	257	293	336	356	367	400	430
Total	**6,338**	**7,416**	**8,265**	**8,765**	**9,028**	**10,812**	**11,400**
Total Inputs	**60,552**	**70,649**	**65,301**	**72,791**	**85,469**	**84,282**	**88,171**

Source: Central Bureau of Statistics.
*Provisional.
**For details *see* Table 81, below.

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Table ~~81~~

CHEMICAL, MEDICINAL AND FEED INPUTS, 1977-1983

K£'000

	1977	1978	1979	1980	1981	1982*	1983*
Other Agricultural Chemicals							
Insecticides	1,762	2,329	2,798	3,247	2,836	3,421	993
Fungicides	3,855	5,855	3,680	4,271	6,580	4,614	2,732
Herbicides	1,552	2,442	2,016	2,340	2,479	4,175	1,677
Plant hormones	28	—	—	—	7	62	53
Total	**7,197**	**10,626**	**8,494**	**9,858**	**11,902**	**12,273**	**5,455**
Livestock Drugs and Medicines							
Dips, Spray fluids	1,321	1,366	1,646	2,367	1,079	2,669	2,711
Vaccines	827	838	221	318	564	793	1,345
Other livestock drugs	1,113	1,102	1,330	1,914	3,410	2,342	1,229
Total	**3,306**	**3,306**	**3,196**	**4,599**	**5,053**	**5,804**	**5,285**
Manufactured Feeds							
Pig feed	1,744	2,306	1,093	1,169	938	703	109
Poultry feed	6,145	8,126	6,769	7,242	8,506	5,131	4,497
Cattle feed	1,302	1,721	989	1,058	1,402	1,889	916
Other feeds	1	1	21	22	3,907	2,806	1,916
Total	**9,193**	**12,154**	**8,872**	**9,491**	**14,753**	**10,529**	**7,438**

Source: Central Bureau of Statistics.
***Provisional**

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Ken.

Milled Rate(enter as decimal in location H3)

Year	Area 1000 ha	FAO Prod. 000 MT (T-1)	ERS Prod. 000 MT (T-1)	ERS Milled 000 MT (T-1)	Calc. Yield ton/ha	Beg. Stocks (1000 MT)	End Stocks (1000 MT)	Aid Imports (1000 MT)	Total Imports (1000 MT)	Exports (1000 MT)	Total Avail. (1000 MT)	Feed Use (1000 MT)	Seed Use (1000 MT)	Waste (1000 MT)	Non-Food (1000 MT)	Consumption (1000 MT)	Indices Prod. Price (govt) local/ton	Indices Population 1,000	Growth Rate (%)	Per cap. Consump. kg	Mktg. Year	Marketing Year Imports 000 MT	Marketing Year Exports 000 MT
1966	1,214	1,500	1,451	0	1.20			143	149	3	1,835	44	23	185	251	1,505	401	9,864	—	160.7	1966/67	394	9
1967	1,170	1,810	1,633	0	1.40			0	0	157	1,498	49	24	163	237	1,261	353	10,192	3.27	123.8	1967/68	0	135
1968	1,214	2,020	1,600	0	1.32			0	1	249	1,319	48	25	160	233	1,086	308	10,532	3.28	103.1	1968/69	0	281
1969	1,250	2,150	1,400	0	1.12			0	0	178	1,210	42	25	140	207	1,003	276	10,868	3.32	92.1	1969/70	0	190
1970	1,255	2,000	1,500	0	1.20			0	14	25	1,510	45	25	152	222	1,288	276	11,256	3.32	114.5	1970/71	15	5
1971	1,255	1,950	1,300	0	1.04			1	29	2	1,329	39	25	133	197	1,132	333	11,649	3.43	97.2	1971/72	29	0
1972	1,250	2,150	1,700	0	1.36			0	0	20	1,681	51	25	170	246	1,435	390	12,068	3.53	118.9	1972/73	0	19
1973	1,250	2,370	1,600	0	1.28			0	0	154	1,573	48	25	160	233	1,140	390	12,513	3.62	91.1	1973/74	0	227
1974	1,250	2,250	1,600	0	1.28			0	1	56	1,540	48	25	160	233	1,307	464	12,983	3.69	100.7	1974/75	0	60
1975	1,250	2,500	1,900	0	1.52			0	0	130	1,779	57	25	190	272	1,507	698	13,481	3.76	111.8	1975/76	0	121
1976	1,250	2,600	2,195	0	1.76		798	0	0	105	1,204	66	25	220	310	974	766	14,008	3.83	69.5	1976/77	0	113
1977	1,250	2,553	2,205	0	1.76	798	860	0	0	0	2,170	66	23	221	310	1,869	809	14,568	3.92	128.3	1977/78	0	25
1978	1,150	2,169	1,895	0	1.65	800	350	0	0	13	2,200	57	27	190	273	1,927	809	15,158	3.97	127.1	1978/79	0	105
1979	1,350	1,755	1,450	0	1.07	350	50	0	0	104	1,865	44	30	162	235	1,630	775	15,770	4.01	105.3	1979/80	165	50
1980	1,480	1,620	1,750	0	1.18	50	180	20	364	10	2,058	53	34	219	305	1,753	1,000	16,431	4.06	106.7	1980/81	438	0
1981	1,690	1,980	2,200	0	1.30	180	500	119	334	5	2,064	66	34	238	339	1,725	1,055	17,117	4.09	100.8	1981/82	184	0
1982	1,720	2,349	2,340	0	1.36	500	600	0	89	6	2,163	70	30	234	335	1,828	1,444	17,835	4.11	102.5	1982/83	0	77
1983	1,520	2,178	2,070	0	1.36	600	353	0	0	39	2,210	62	29	207	298	1,912	1,600	18,586	4.12	102.9	1983/84	0	107
1984	1,450	1,275	1,700	0	1.17	353	496	31	250	0	2,168	51	35	231	317	1,851	1,733	19,371	4.14	95.6	1984/85	611	0
1985	1,730		2,650	0	1.53	496	561	125	315	0	2,385	80	0	265	345	2,041	1,944	20,194	4.16	101.6	1985/86	0	200
1986						561												21,008	3.95		1986/87		
																					1987/88		

ERS

Suppliers UN
81-83:FAO

Feed: 3% Prod.
Seed: 2% area
Waste: 10% avail.

84 & 85
WFS

225

Draft

OCT 26 1986

SRI Format 3 Kenya - Wheat

Milled Rate: (enter as decimal in location H3)

Year	Area 1000 ha	FAO Prod. 000 MT (T-1)	ERS Prod. 000 MT (T-1)	ERS Milled 000 MT (T-1)	Calc. Yield ton/ha	Beg. Stocks	End Stocks	Aid Imports	Total Imports	Exports	Total Avail. 1000 MT	Feed Use	Seed Use	Waste	Non-Food	Consumption	Prod. Price (govt) local/ton	Indices Population 1,000	Growth Rate (%)	Per cap. Consump. kg	Mktg Year	Imports 000 MT	Exports 000 MT
1966	109	128	128	0	1.17			4	27		112	4	2	15	22	90	523	9,864	—	9.1	1966/67	27	43
	121	162	162	0	1.34			1	7	0	166	5	3	19	27	139	545	10,192	3.27	13.7	1967/68	32	28
	133	216	216	0	1.62			3	3	1	188	6	3	22	32	156	568	10,532	3.28	14.8	1968/69	8	36
	140	242	242	0	1.73			0	2	19	172	7	3	24	34	138	563	10,808	3.32	12.6	1969/70	2	72
1970	137	221	222	0	1.62			2	3	52	150	7	2	23	32	118	545	11,256	3.32	10.5	1970/71	6	70
	121	206	206	0	1.70			2	16	151	154	6	2	21	29	125	451	11,649	3.43	10.7	1971/72	8	60
	93	164	164	0	1.76			2	68	4	224	5	2	24	30	194	506	12,068	3.53	16.1	1972/73	72	12
	89	136	150	0	1.69			1	78	5	128	5	2	18	25	104	506	12,513	3.62	8.3	1973/74	32	54
	100	172	149	0	1.49			0	14	0	203	4	2	21	28	175	567	12,983	3.69	13.5	1974/75	63	9
1975	105	158	158	0	1.50			5	83	0	227	5	2	23	30	197	804	13,481	3.76	14.6	1975/76	74	5
	117	200	176	0	1.50		101	9	40	5	116	5	2	22	30	87	1,047	14,008	3.83	6.2	1976/77	46	5
	113	178	178	0	1.58	101	60	13	34	0	232	5	2	19	27	205	1,203	14,568	3.92	14.1	1977/78	17	4
	119	175	166	0	1.39	60	24	6	92	0	274	5	2	24	31	243	1,333	15,150	3.97	16.0	1978/79	75	3
	117	207	201	0	1.72	24	73	17	22		237	6	3	29	37	200	1,333	15,778	4.01	12.7	1979/80	85	0
1980	125	216	189	0	1.51	73	67	89	90	0	255	6	3	25	33	222	1,436	16,431	4.06	13.5	1980/81	60	0
	135	214	213	0	1.58	67	112	72	154	0	308	6	3	35	45	263	1,667	17,117	4.09	15.4	1981/82	140	0
	145	235	225	0	1.55	112	124	130	139	0	339	7	2	35	44	295	1,777	17,835	4.11	16.5	1982/83	126	0
	115	242	205	0	1.78	124	160	124	126	0	385	6	2	36	44	341	2,167	18,586	4.12	18.3	1983/84	156	0
	100	100	95	0	0.95	160	29	177	180	0	417	5	3	35	42	375	2,690	19,371	4.14	19.4	1984/85	251	0
1985	125		250	0	2.00	29	84	200	360	0	435	8	0	49	57	379	2,933	20,194	4.16	18.7	1985/86	240	

ERS

Suppliers UN

Feed: 3% Prod.
Seed: 2% area
Waste: 10% avail.

84 & 85
WFS

229

Draft

[illegible] - Rice

JUN 30 1986

Milled Rate(enter as decimal in location H3) 0.63

Year	Area 1000 ha	FAO Prod. 000 MT (T-1)	EFS Prod. 000 MT (T-1)	ERS Milled 000 MT (T-1)	Calc. Yield ton/ha	Beg. Stocks	End Stocks	Aid Imports	Total Imports	Exports	Total Avail. 1000 MT	Feed Use	Seed Use	Waste	Non-Food	Consumption	Prod. Price (govt) local/to	Indices Population 1,000	Growth Rate (%)	Per cap. Consump. kg	Mktg Year	Marketing Year Imports 000 MT	Marketing Year Exports 000 MT
1966	3	17	17	11	5.67			0	3		14	1	0	2	3	11	465	9,364	---	1.1	1966/67	4	1
	3	16	16	10	5.33			0	5	0	8	0	0	2	2	6	441	10,172	3.27	0.6	1967/68	0	2
	3	19	19	12	6.33			0	3	2	14	1	0	2	3	11	455	10,532	3.28	1.9	1968/69	4	2
	5	23	23	14	4.60			0	3	1	11	1	0	2	3	8	458	10,888	3.32	0.8	1969/70	0	3
1970	5	29	29	18	5.80			0	5	0	19	1	0	3	4	14	459	11,256	3.32	1.3	1970/71	1	1
	6	30	32	20	5.33			0	11	0	24	1	0	5	6	28	597	11,649	3.43	2.4	1971/72	15	1
	7	35	30	19	4.29			0	9	1	21	1	0	3	4	17	484	12,068	3.53	1.4	1972/73	3	1
	7	36	36	23	5.14			0	2	3	18	1	0	4	5	13	508	12,513	3.62	1.0	1973/74	0	5
	7	33	33	21	4.71			0	0	0	14	1	0	3	4	9	504	12,983	3.69	0.7	1974/75	0	7
1975	6	32	32	20	5.33			0	0	0	20	1	0	3	4	16	586	13,481	3.76	1.2	1975/76	0	0
	7	40	40	25	5.71		6	0	16	0	26	1	0	6	7	29	1,045	14,008	3.83	2.0	1976/77	16	0
	7	41	43	27	6.12	6	4	0	2	0	27	1	0	4	6	21	1,367	14,560	3.92	1.5	1977/78	0	2
	7	43	38	24	5.44	4	2	0	2	2	28	1	0	4	5	23	1,369	15,158	3.97	1.5	1978/79	2	0
	9	37	41	26	4.59	2	2	0	11		30	1	0	5	6	24	1,449	15,779	4.01	1.5	1979/80	4	0
1980	8	40	40	25	4.96	2	2	12	14	0	31	1	0	5	6	25	1,500	16,431	4.06	1.5	1980/81	6	0
	8	39	41	26	5.16	2	5	12	12		39	1	0	6	7	32	1,500	17,117	4.09	1.7	1981/82	16	0
	9	43	38	24	4.23	5	35	16	42		41	1	0	9	10	31	1,700	17,835	4.11	1.7	1982/83	47	0
	9	37	36	23	4.00	35	34	22	45		50	1	0	6	8	42	2,700	18,586	4.12	2.3	1983/84	28	0
	9	31	36	23	4.00	36	11	0	8		56	1	0	4	6	50	3,250	19,371	4.14	2.6	1984/85	8	0
1985	9		39	25	4.33	11		0	10		51	1	0	6	8	43		20,194	4.16	2.2	1985/86	25	0
																					1986/87		
																					1987/88		

ERS

Suppliers UN

Feed: 3% prod.
Seed: 2% area
Waste: 10% avail.

84 & 85
WFS

230

Draft

KENYA-OTA

INDICATORS OF TYPES OF DATA
AVAILABLE FROM FARM MGMT. ~~HANDBOOK~~.

BUSIA DISTRICT

TABLE [illegible]: COMPOSITION OF HOUSEHOLDS PER LOCATION AND DIVISION[a)]

LOCATION/DIVISION	No. of Households total	Farmers Family [b)]			Non-Relatives	Person Househ total
		Adults >15 years	Children < 15 years	Other Relatives		
Location:						
North Teso	6267	3.08	1.29	0.45	0.28	5.10
South Teso	8603	3.26	1.34	0.71	0.28	5.50
Division Northern	14870	3.19	1.32	0.60	0.28	5.39
Location:						
Bukhayo	10759	3.06	1.38	0.75	0.27	5.46
Marachi	9724	2.96	1.29	1.11	0.34	5.71
Division Central	20483	3.00	1.35	0.92	0.30	5.57
Location:						
Samia	8356	2.95	1.17	1.07	0.46	5.65
Bunyala	5752	2.63	0.72	1.33	0.55	5.22
Division Hakati/ Southern	14108	2.82	0.98	1.17	0.55	5.48
Location:						
Busia Urban	1106	2.22	0.65	0.65	0.55	4.07
South Teso	1400	2.57	0.85	0.70	0.48	4.61
Bukhayo	3126	2.39	0.84	0.58	0.35	4.15
Division Busia Township	5632	2.39	0.81	0.62	0.42	4.25
DISTRICT: BUSIA	55093	2.99	1.14	0.87	0.36	5.36

a) Source: Central Bureau of Statistics (CBS)

b) Average figures, includes one and two persons per household as well.

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TABLE 6: AEZ-LAND AREA AVAILABLE PER LOCATION, DIVISION AND PER HOUSEHOLD AND PERSON

Location/Division without townships	in '00 ha = sqkm					in '00 ha = sqkm				in ha	
	Area total (Census) 79	Non-agricultural land			Agri-cultural land	Area in agro-ecological zones AEZ				Agric. land per	
		Unsuit. steep slopes	Forest Res., lakes, swamps	Others (roads, home-steads rivers...)		LM 1	LM 2	LM 3	LM 4	household	person
North Teso	200	2		20	178		81	97		2.83	0.55
South Teso	306	2		31	273	85	180	8		3.15	0.56
Northern Division	506	4		51	451	85	261	105		2.99	0.55
Bukhayo	407	2		41	364	221	118	25		3.40	0.62
Marachi	236			24	212	196	16			2.18	0.38
Central Division	643	2		65	576	417	134	25		2.77	0.49
Samia	248	13		25	210		30	167	13	2.50	0.44
Bunyala	182	2	sw 50	18	112			30	82	1.85	0.37
Southern Division	430	15	50	43	322		30	197	95	2.25	0.42
Total rural area	1 579	21	50	159	1 349	502	425	327	95	2.72	0.57

For official land statistics see supplementary publication to FM-Handbook, Vol. III A: Agriculture Land Statistics.

AGRICULTURAL STATISTICS

Roughly 27,000 ha of cotton are planted within the district annually. Seventy-five percent of the crop is interplanted into maize, yielding between 200 and 500 kg of seed cotton per ha. Other important cash crops are sugar cane and groundnuts and (very localised) tobacco.[1)]

BUSIA DISTRICT

TABLE 7: COTTON PRODUCTION[a)]

Ginnery Zone	Year				
	1975/76	1976/77	1977/78	1978/79	1979/80
Samia					
Seed Cotton in t	3850	2086	1876	2789	2516
Bales	6756	3661	3292	4893	4415
Nambale					
Seed Cotton in t	1936	1686	1907	2830	3005
Bales	3398	2958	3346	4965	5273

a) Source: C.L. & S.M.B., does not refer to district area only

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BUSIA DISTRICT

TABLE 9a: ASSETS, LAND USE, FARMING INTENSITY, INPUTS

AEZ: LM 1

Survey Area 09

Range	Assets			People on Farm		
	Land ha	Livestock head	Equipment pieces	Family Adults	Perm.Hrd. Labourers	Children > 14 No.
Avg. 0	7.3	9.6	0.8	2.8	0.1	1.5
Avg. 1	7.3	11.1	1.5	2.8	1.5	2.2
Up. Qu.	10.0	14.0	1.0	3.0	-	2.0
Lo. Qu.	3.0	2.0	-	2.0	-	-

Land Use

Range	Annual Crops ha	%	Perm. Crops ha	%	Pasture ha	%	Forage ha	%	Fallow ha	%	Other Use ha	%
Avg. 0	2.5	35	0.5	7	3.4	48	-	-	0.5	7	0.3	4
Avg. 1	2.5	30	1.1	13	3.7	44	-	-	0.8	10	0.3	3
Up. Qu.	3.2	57	0.8	15	5.2	54	-	-	0.8	12	0.3	7
Lo. Qu.	1.2	28	-	-	0.6	13	-	-	-	-	0.1	2
Total	75.2		14.2		102.7		-		15.9		7.9	

Farming Intensity

Range	Cropping Intensity crops/yr.	Stocking Rate		Improved Cattle % of total
		Farm Land LU/ha	Pasture & Forage LU/ha	
Avg. 0	0.9	0.5	1.0	-
Avg. 1			0.9	-
Up. Qu.	1.0	1.0	4.2	-
Lo. Qu.	0.7	0.1	0.1	-

Inputs Applied

Range	Improved Seed Used % of area	Fertiliser Applied pure nutrient kg/ha						Manure Applied t/ha		Plant Protection			
		N		P_2O_5		K_2O				Insecticide kg/ha		Fungicice kg/ha	
	AC	AC	PC	AC	PC	AC	PC	AC	PC	AC	PC	AC	PC
Avg. 0	46.9	0.2	0.5	2.8	-	-	-	0.1	-	1.8	-	-	-
Avg. 1	51.8	5.1	20.0	5.0	-	-	-	0.7	-	2.1	-	-	-
Up. Qu.	92.3	-	-	3.3	-	-	-	-	-	3.1	-	-	-
Lo. Qu.	28.6	-	-	-	-	-	-	-	-	0.2	-	-	-

Notes: Avg. 0 = average of all sample farms
Avg. 1 = average of farms, excluding zero entries
Up. Qu./Lo. Qu. = Upper/Lower Quartile, refers to individual farm,50 % of all sample cases lie between these points
AC = Annual Crops
PC = Perennial Crops

DRAFT

The Role of Low-Resource Agriculture in Africa:
Malawi ,Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW RESOURCE AFRICAN AGRICULTURE

MALAWI Supplementary Information

1. Production Statistics

a. Agricultural production in Malawi is derived from two subsectors-smallholders and estates. Over 70% of Malawi's total arable land area of 36,200 square km. is farmed by smallholders and about 5% by estates. Smallholders who grow a variety of crops account for nearly 80% of total production. Smallholders grow maize,groundnuts, tobacco, cotton, beans, cassava, rice, sorghum and millet, although in the past few years maize has emerged as an important smallholder crop. Tobacco, tea and sugar are important crops produced in the estate subsector. Table 1 shows estimates of land utilization by agricultural development divisions for 1980/81. (This gives a breakdown by smallholder and estates as well as production of maize,tobacco, rice, groundnuts and cotton). Aggregate crop production from the estate sector is shown in table 2 for the period 1968-81. See Figures 1 and 2 for agroecological zones and political map.

b. Agriculture provides 40% of total GDP, 80-90% of the country's foreign exchange earnings and employs about 85% of the labor force. In 1983, the smallholder subsector provided 78% of agricultural GDP.

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c. The value of agricultural export earnings by crop and total export earnings for the period 1979-1984 is shown in table 3.

2. Producers

Due to the structural characteristics of the agricultural sector (i.e., the estate and smallholder sector) and the employment of approximately 30,000 individuals working in South Africa, it is difficult to ascertain the distribution of income by sex within the agricultural sector as remittances play an important part in the earnings of rural households. In 1984 it was estimated that 17% of the country's GDP came from remittances. (Source: Larry Witucki, Malawi country specialist USDA/ERS/IED, Washington, D.C.). We, however, use data from microstudies to illustrate variability in resource use in selected areas in Malawi . Our primary source of data is a paper by Art Hansen et al. on "Farming Systems Research in Phalombe Project, Malawi," undated mimeo. This paper reports on field work done in 1981/82. This project is part of the Blantyre Agricultural Development Division and is located in southeastern Malawi. In the project area 37% of rural households are women headed households compared to 28% for Malawi. The average holding is approx. 1 ha., and more than 60% of households cultivate less than 1 ha. Maize is the most important crop with over 75% of cultivated land being planted to maize. It is usually intercropped with pulses, groundnuts, millet/sorghum or cassava.

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Data from the TEA Association of Malawi show that the Tea estate sector employed 26,521 men and 8,046 women (and juveniles) in 1980.

Another microlevel study that could detail specific food production activities and decision making responsibilities by sex is "Women Farmers of Malawi- Food Production in the Zomba district", by David Hirschmann and Megan Vaughan. This microlevel study is based on interviews of 70 women from fifty four villages and is published by the Institute of International Studies, University of California, Berkeley. We however did not have access to this study.

3. Method of Production.

a. Irrigated/rainfed.

Rice and sugarcane are the major crops which are grown under irrigation. While rice is grown under smallholder conditions, sugarcane is grown under estate conditions. Figure 3 shows the location of these irrigation schemes.

b. Types and amounts of commercial inputs.

Fertilizer is the most important commercial input which is use both in the smallholder and the estate sector. Tables 4-5 show estimated fertilizer use by crop and subsector as well as by type for smallholders.

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c. Intercropping/monocropping.

As discussed earlier intercropping is practised in the smallholder sector. However, with smallholders shifting their cropping patterns and growing an improved maize variety, the extent of intercropping will decrease. See table 6 on projections of changing cropping patterns of smallholders between 1980/81 and 1990/91.

4. Consumption and Storage

Increased production of maize by smallholders has led to the government increasing its modern storage capacity for the crops that it markets. These storage facilities exceed 180,000 m. tons. Similar data as to the extent of onfarm storage available in the smallholder sector is not available.

Additional tables have been provided on:

1) Rice production and exports-Table 7
2) Sugar production and exports- Table 8
3) Tea- area, production and exports - Table 9
4) Livestock - number and type- Table 10
5) Fish production, imports and exports - Table 11

FIG. 1 MALAWI - AGROECOLOGICAL ZONES

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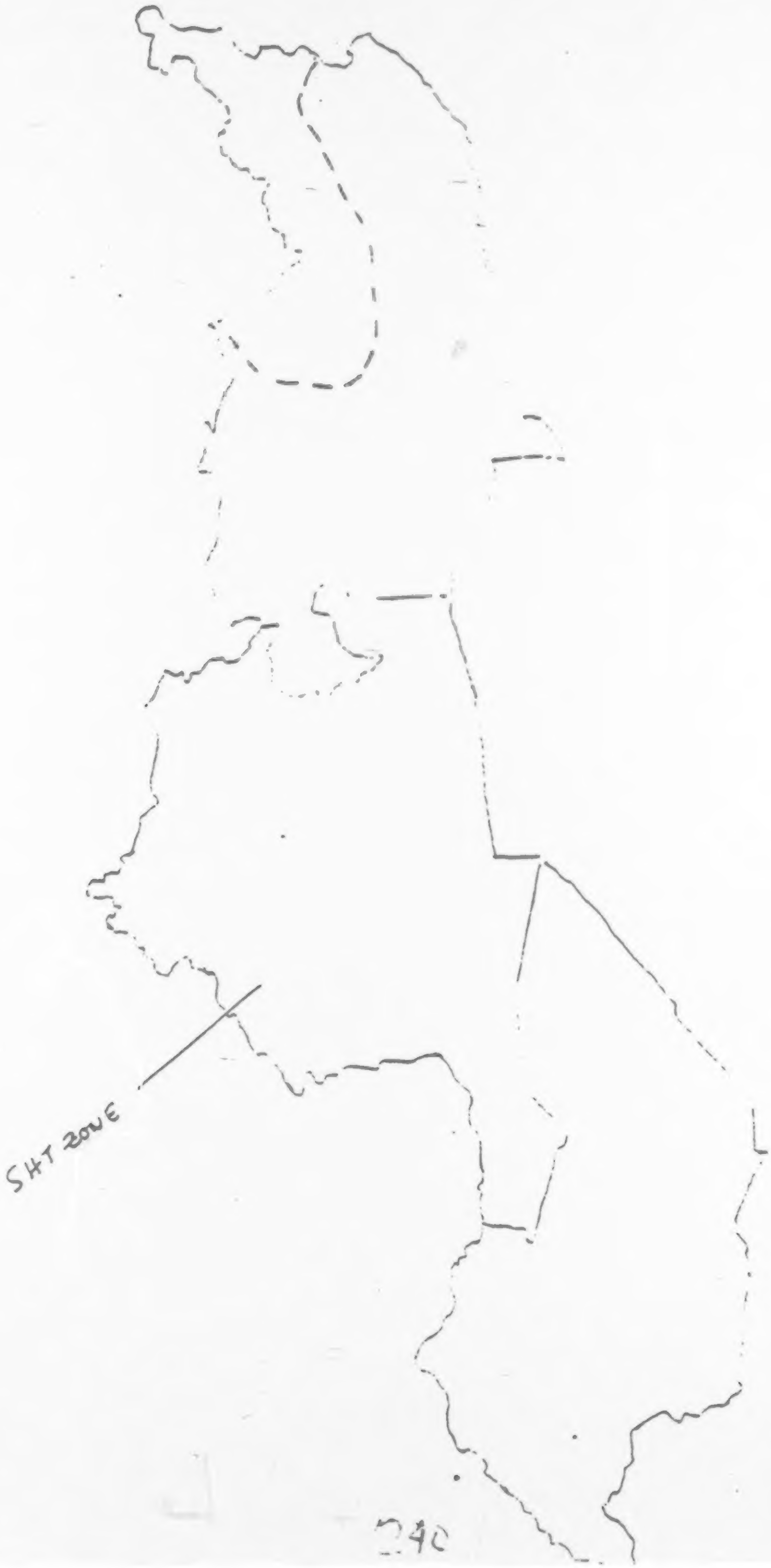

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IBRD 1521?
JULY 198?

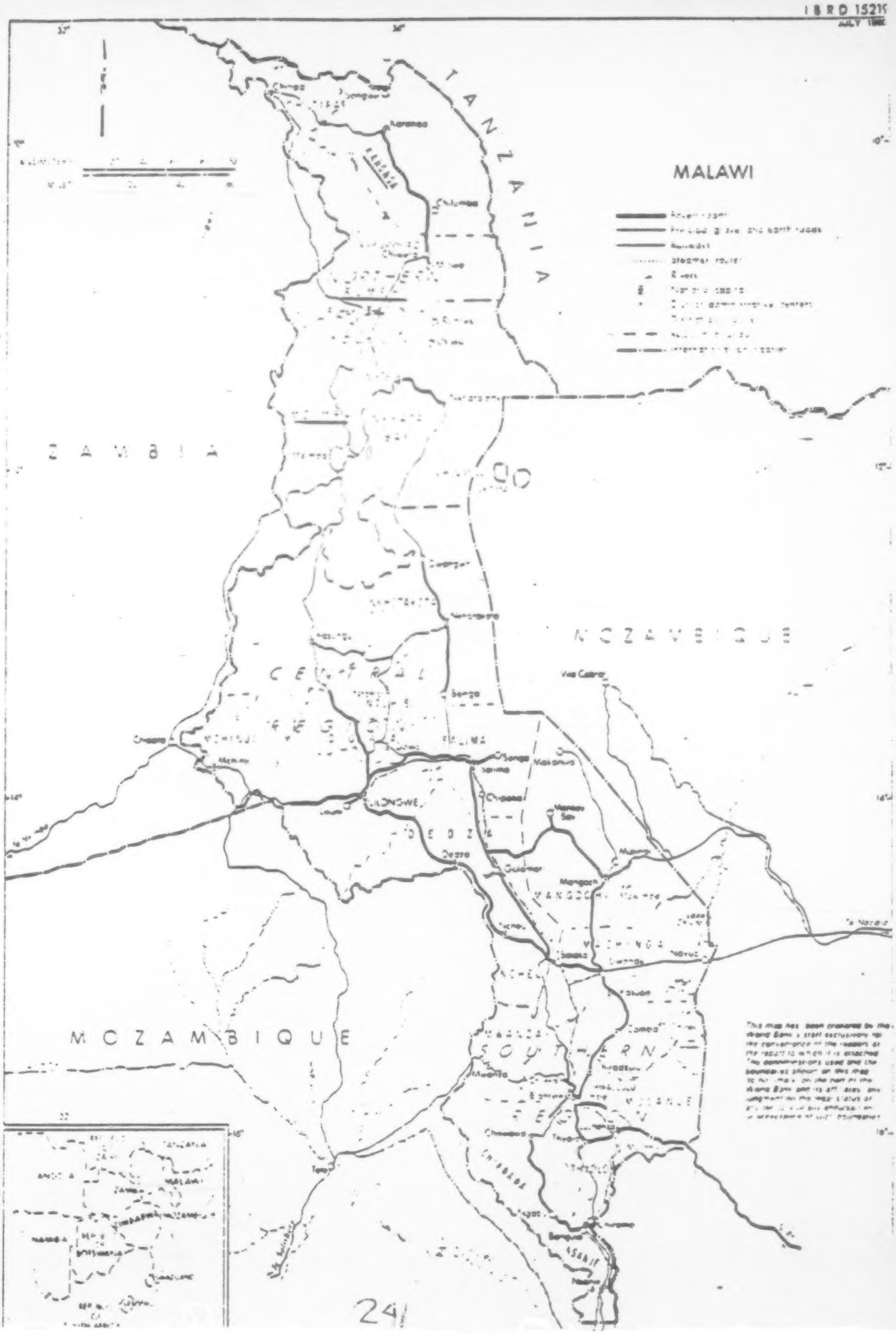
MALAWI
TANZANIA
ZAMBIA
MOZAMBIQUE
MOZAMBIQUE
Principal gravel and earth roads
Steamer routes
Rivers
CENTRAL REGION
SOUTHERN REGION
Chitipa
Karonga
Chilumba
Chipata
Lilongwe
LILONGWE
Salima
SALIMA
DEDZA
Dedza
Mangochi
MANGOCHI
MACHINGA
Zomba
Tete
To Nacala
CHIKWAWA
NSANJE
MULANJE
ANGOLA
ZAMBIA
MALAWI
TANZANIA
NAMIBIA
BOTSWANA
REP. OF SOUTH AFRICA

FIG. 3 – MALAWI

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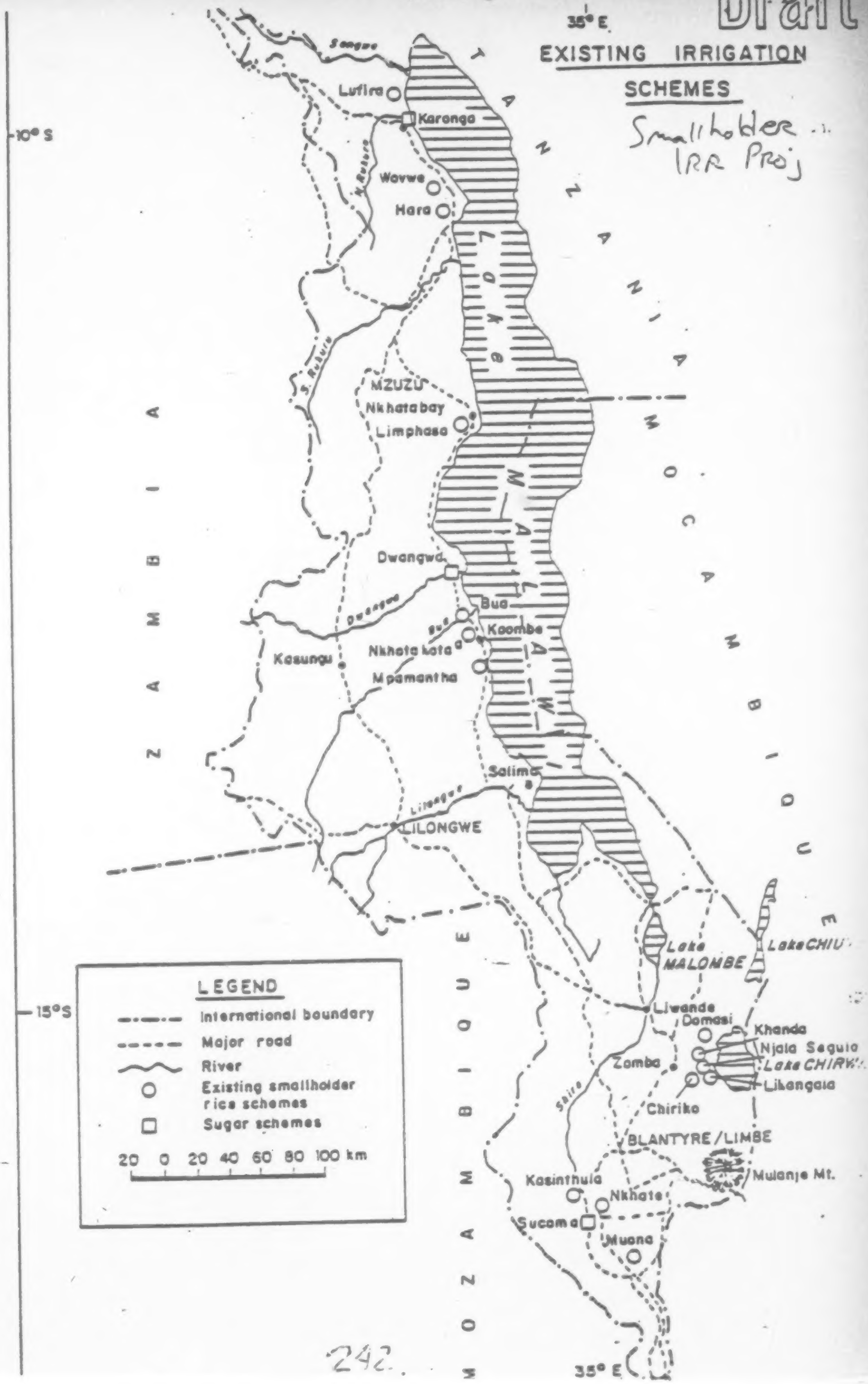
EXISTING IRRIGATION SCHEMES

Smallholder IRR Proj


35° E
10° S
15°S
35° E
TANZANIA
MOCAMBIQUE
MOZAMBIQUE
ZAMBIA
LAKE MALAWI
Songwe
Lufira
Karonga
N. Rukuru
Wovwe
Hara
S. Rukuru
MZUZU
Nkhatabay
Limphasa
Dwangwa
Dwangwa
Bua
Bua
Kaombe
Nkhotakota
Kasungu
Mpamantha
Salima
Lilongwe
LILONGWE
Lake MALOMBE
Lake CHIUTA
Liwonde
Domasi
Khanda
Njala Segula
Lake CHIRWA
Zomba
Likangala
Chiriko
Shire
BLANTYRE/LIMBE
Mulanje Mt.
Kasinthula
Nkhate
Sucoma
Muona
LEGEND
International boundary
Major road
River
Existing smallholder rice schemes
Sugar schemes
20 0 20 40 60 80 100 km

242

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Women Farmers of Malawi

Food Production in the Zomba District

DAVID HIRSCHMANN and MEGAN VAUGHAN

> In the precolonial societies of Africa women were usually subordinate to men in status and influence, but there were structures and relationships which assured women a degree of prestige, power, and autonomy. Their contribution to the vital task of food production was acknowledged and respected. . . . In the colonial period the subordination of women became more intense and restricting. Administrators and missionaries, in employment and educational programs, gave their main attention to men and boys, increasing the differences in stature and power between men and women. . . . In the post-colonial experience, women's contribution to agricultural production has been underrated and undervalued. Although it is widely acknowledged that women do most of the work in agriculture, in official statistics they tend to remain invisible. . . .
>
> It seemed to us that there was a particularly valid case for undertaking a study of women farmers. For our study Malawi was a particularly suitable area. . . . The economy depends very heavily on agriculture, not only for food production, but also for employment and exports. . . . The population remains overwhelmingly rural—91.7 percent. Men are leaving their farms in large numbers to search for employment in the rapidly expanding estate sector; consequently there has been a marked growth in women's responsibility for smallholder agriculture. . . .
>
> *Excerpted from the* INTRODUCTION

David Hirschmann and Megan Vaughan provide a detailed survey of women farmers in the Zomba district of Malawi, based primarily on interviews of seventy women from fifty-four villages. The main focus of the survey is food production activities, but family relationships and forms of community involvement are also discussed. . . . Of the seventy women interviewed, thirty-eight were living with their husbands. The many different ways labor and decision-making responsibilities are divided between husbands and wives—both in household matters and all phases of agricultural production—are of special interest. . . . "Case studies" of twelve of the women farmers are included, with concrete details about their everyday lives and experiences.

DAVID HIRSCHMANN, Visiting Associate Professor of Government and Law, Lafayette College (Pennsylvania), is former head of the Department of Public Administration, University of Malawi. **MEGAN VAUGHAN** is a Chapman Fellow at the Institute of Commonwealth Studies, University of London.

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FERTILIZER

Smallh Fert. Proj Appraisal

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Annex 3
Table T-1

TABLE 1 - OTA.

MALAWI

SMALLHOLDER FERTILIZER PROJECT

AREA + YIELD

Estimated Land Utilization for 1980/81 (Analysis by ADD) 1/

Ind
-cassava
— [illegible]
sugar

	Ngabu ADD	Blantyre ADD	Liwonde ADD	Salima ADD	Lilongwe ADD	Kasungu ADD	Mzuzu ADD	Karonga ADD	Total
No. of Farm Families	65,000	275,000	245,000	79,200	256,000	122,000	77,000	30,000	1,149,200
Mean Household Size (members)	4.4	4.6	4.1	4.3	4.4	4.9	4.8	4.8	4.5
% Growth	2.0	3.0	2.8	2.9	3.0	2.9	2.8	2.5	2.9
Mean Farm Size (cultivated) (ha)	1.36	0.8	0.86	1.02	1.38	2.08	1.39	0.98	1.16
Cultivated (area cropped) 2/	88,400	220,000	210,000	80,000	354,000	294,000	101,000	30,000	1,377,400
Total Land leased to Estates (Est) (ha) 3/	9,240	61,500	70,000	42,260	40,000	200,000	47,000	-	470,000
Maize Total Area (ha) (smallholders)	30,000	125,400	140,300	48,000	209,000	180,000	58,000	11,100	801,800
Improved Maize (ha)	500	3,000	2,730	4,720	34,000	25,000	13,000	2,100	85,050
Mean Yield (kg/ha)	855	900	900	1,300	1,300	1,400	1,400	1,400	1,200
Tobacco Total Area (ha)	-	900	800	160	19,000	20,000	500	-	41,360
Northern Division Dark-Fired (NDDF) (ha)	-	900	400	-	18,400	12,000	-	-	31,700
Mean Yield (kg/ha)	-	400	320	-	500	450	-	-	450
Rice Total Area (ha)	1,100	2,420	7,000	4,240	-	-	500	7,000	22,260
Improved Rice Total	800	1,100	5,000	2,880	-	-	400	5,700	15,880
Mean Yield (kg/ha)	2,200	600	1,700	1,300	-	-	1,900	2,500	1,800
Groundnut Total Area (ha)	800	2,000	4,400	4,100	5,600	64,000	8,700	300	140,300
Improved Groundnuts Total Area (ha)	800	1,760	3,990	3,700	53,000	57,000	5,700	150	121,200
Mean Yield (kg/ha)	400	200	400	450	250	450	280	440	400
Cotton Total Area (ha)	20,000	2,000	4,600	11,500	700	-	-	200	39,000
Mean Yield (kg/ha)	500	620	600	700	450	-	-	500	500

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1/ **Source:** From the National Sample Survey of Agriculture for Customary Land 1980/81 and also from Agricultural Development Divisions/ ADDs Estimates.

2/ Small Farming Sector Study.

3/ Only an estimated 90,000 ha was cropped in 1980/81.

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2 - 0TA

Table ~~[illegible]~~ CROP PRODUCTION FROM THE ESTATE SECTOR, 1968-81

CROP	UNITS	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1. **Tea**															
Acreage Producing	'000 acres	35.7	37.1	37.6	38.4	39.1	40.1	40.9	41.8	42.3	43.0	44.0	44.7	..	..
Total Production	ST	7430	18647	20648	20519	22798	25963	25704	28922	31208	34864	34932	33238	..	..
Value of Exports	Million kwacha	9.7	9.5	10.9	11.9	12.0	13.7	17.2	21.7	26.4	41.6	29.2	30.7	33.1	..
2. **Sugar**															
Acreage Harvested	'000 acres					7.8	10.8	16.0	21.0	23.2	23.3	22.7	..	..	..
Total Production	ST					37218	53971	51764	75543	95961	105038	103040	119576	163803	..
Value of Exports	Million kwacha	n.a.	0.2	0.2	0.3	0.4	3.3	9.2	12.3	23.2	14.9	11.4	13.99	13.21	..
3. **Flue-Cured Tobacco**															
Acreage Planted	'000 acres	5.5	7.0	9.8	14.3	17.6	19.5	23.5	26.4	32.0	37.9	43.3	46.7	46.2	36.8
Purchases	ST	3030	3055	5154	7065	9533	11013	11599	16423	17824	21589	22985	27630	[illegible]	21685
Average Auction Price	t/lb	35.93	39.44	37.96	41.17	40.44	58.63	67.54	58.86	67.06	78.09	77.68	71.66	[illegible]	81.34
Total Value at Auction	Million kwacha	2.2	2.4	3.9	5.8	7.7	12.9	15.7	19.3	23.9	33.7	35.7	39.7	26.6	35.3
4. **Burley Tobacco**															
Acreage	'000 acres	7.6	10.1	13.9	18.1	16.1	16.2	16.8	17.7	21.6	21.4	26.1	34.1	36.1	39.5
Purchases	ST	3336	3816	6255	6245	6011	6257	5922	8815	7275	11211	11666	16392	18356	20684
Average Auction Price	t/lb	25.11	36.95	28.39	23.87	25.20	36.68	49.65	42.33	46.88	62.30	52.49	48.76	53.41	105.06
Total Value at Auction	Million kwacha	1.7	2.8	3.6	3.0	3.0	4.6	5.8	7.5	6.8	14.0	12.2	16.0	19.6	41.6

..: not available

Source: National Statistical Office, Compendium of Agricultural Statistics, 1976; Annual Statement of External Trade, 1975 IBRD Agricultural Sector Review 1973: Ministry of Agriculture and Natural Resources, 1979.

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MALAWI - OTA

Table 3-[redacted] EXPORTS
(US$ Millions - FOB)

	1979	1980	1981	1982	1983	1984
Tobacco	120.7	124.1	118.2	138.1	116.4	137.2
Tea	37.5	36.7	36.2	42.9	47.6	79.6
Sugar	19.7	46.4	63.3	23.0	23.1	20.7
Groundnuts	10.9	19.6	12.4	4.4	2.5	1.7
Cotton	2.2	5.5	1.7	0.3	0.0	0.0
Maize	-	-	-	-	9.5	34.8
Other	31.4	52.1	55.8	33.4	31.4	31.1
TOTAL	222.4	284.4	287.6	242.1	230.5	305.1

Source: RBM, NSO

TABLE 4

MALAWI

SMALLHOLDER FERTILIZER PROJECT

Estimated Fertilizer Use by Crop and Sub-Sector 1/

	Cultivated Area 1978/79	Cultivated Area 1980/81	Fertiliser Type	Recommended	Actual Estimated	Fertiliser Use 1978/79	Fertiliser Use 1980/81	% of T 1980/
	ha			kg/ha		mt		
Estate Sector Major Crops								
Maize	6,500	7,000	3-2-1 CAN	500 250	400 180	2,600 1,170	2,800) 1,260)	
Tobacco								
Flue-cured	18,700 2/	14,800	Tobacco mix	600-700	550-600	18,018	18,360)	
Burley	13,600	15,800	CAN + others	200-400	240	7,676	7,344)	
Sub-Total Area:	32,300	30,600						
Tea (excluding smallholder use)	16,000	16,273	Urea or 25:5:5 3/	150 of N	150 of N	9,600 900	9,800) 900)	
Sugar Cane	15,000	15,000	SA & Urea	n/a	n/a	5,000 2,000	4,000) 3,500)	
TOTALS:	69,800	68,873				46,964	47,964 4/	
Smallholder Sector Major Crops								
Maize								
Local	140,000	160,000	SA	250	100	14,000	16,000	
Composite	12,000	21,000	20:20:0 SA	150 250	100 200	1,200 2,400	2,100) 4,200)))	
Hybrid	36,000	64,000	20:20:0 SA	250 250	150 200	5,400 7,200	9,600) 12,800)	
Tobacco								
NDDF	32,000	32,000	20:20:0 SA	250 150	200 100	3,200 6,400	3,200) 6,400))	
Others	9,400	9,400	20:20:0 SA	n/a	50 50	500 500	500) 500)	
Rice Improved	16,000	16,000	SA	200	100	1,600	1,600	
Tea	2,000	2,200	25:5:5 or SA	150 kg of N	150 kg of N	1,200	1,320	
TOTALS	247,000	304,600				43,600	58,220 4/	

1/ Information obtained from GOM Fertilizer Factory Study (UNIDO); Agricultural Development Division information, and the NSSA 1980/81 re

2/ An all time high.

3/ Or any other mixture provided that for every 5 kg N, 1 kg P_2O_5 and K_2O is applied.

4/ Based on fertilizer applications not ADMARC or Optichem Sales.

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ANNEX 1
Table [illegible]-5

TABLE 5

MALAWI

Smallholder Fertilizer Project

Actual & Estimated Smallholder Fertilizer Use (Principal Fertilizers)

- mt -

	80/81		81/82		82/83		83/84		84/85		85/86		86/87
	S.A.	20:20:0	S.A.	20:20	S.A.	20:20	S.A.	20:20	S.A.	20:20	S.A.	20:20	S.A.
MAIZE 1/ hybrid	12,800	9,600	13,400	10,000	14,000	10,500	14,800	11,100	15,500	11,600	16,600	12,500	18,100
Composite	4,200	2,100	4,400	2,100	4,700	2,400	4,900	2,500	5,200	2,600	5,500	2,800	6,000
Fertilised local	16,000	—	16,500	—	17,000	—	17,500	—	18,400	—	19,700	—	21,400
TOTAL	33,000	11,700	34,300	12,100	35,700	12,900	37,200	13,600	39,100	14,200	42,800	15,300	45,500
TOBACCO 2/													
NDDF	3,200	6,400	3,400	6,700	3,500	7,000	3,700	7,400	3,900	7,800	4,200	8,300	4,500
Others	500	500	500	500	400	400	400	400	300	300	250	250	200
TOTAL	3,700	6,900	3,900	7,200	3,900	7,400	4,100	7,800	4,200	8,100	4,450	8,580	4,700
RICE 3/													
Improved	1,588	—	1,667	—	1,751	—	1,838	—	1,930	—	2,060	—	2,250
Local	319	—	302	—	283	—	262	—	240	—	210	—	190
TOTAL	1,907	—	1,969	—	2,034	—	2,100	—	2,170	—	2,270	—	2,440
TEA (SA+25:5:5)	1,100	—	1,200	—	1,300	—	1,400	—	1,500	—	1,600	—	1,700
COFFEE	100	—	100	—	150	—	250	—	400	—	550	—	700
KFCTA	1,250	—	1,250	—	1,250	—	1,250	—	1,250	—	1,250	—	1,250
TOTAL FERTILIZERS	41,087	18,600	42,719	19,300	44,334	20,300	46,300	21,400	48,620	22,300	52,920	23,880	56,290
Other Types + Misc	3,000		3,500		4,000		4,500		5,000		5,500		6,000
TOTAL SMALLHOLDERS	62,687		65,519		68,634		72,200		75,920		83,200		88,290
ADMARC SALES	41,500	12,700	46,400	14,600	53,400	25,700	52,100	18,000	57,300	19,600			
SA+20:20:0	54,200		61,000		79,100		70,100		76,900				
CAN, Others	10,200		6,100		7,300		13,700		15,200				
TOTAL	64,400 4/		67,100 5/		86,400 5/		83,800 6/		92,100 6/				
DIFFERENCE	1,713		1,581		17,766		11,600		16,180				

1/ Maize average fertilizer use hybrid 150 kg 20:20:0 and 200 kg SA; Composite 100 kg 20:20:0 and 200 kg SA; local 100 kg SA per hectare.
2/ Tobacco average fertilizer use NDF 200 kg 20:20:0 and 100 SA; others 50kg 20:20:0 and 50 kg SA.
3/ Rice average fertilizer use 100-125 kg SA per hectare.
4/ Based on actual sales.
5/ Based on ADD estimates.
6/ Based on GOM future projections.

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TABLE 6

ANNEX 3
Table T-6

MALAWI

Smallholder Fertilizer Project

Estimated Total Maize Crop Production and Family Consumption

		1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987/88	1988/89	1989/90	1990/91
Maize 1/												
hybrid ha 1/	ha	64,000	67,000	70,000	74,000	77,500	82,900	90,400	99,440	109,384	120,322	131,151
composite 1/	ha	21,000	22,000	23,500	24,500	26,000	27,800	30,300	33,330	36,663	40,329	43,958
improved local 2/	ha	160,000	165,000	174,000	179,000	185,000	194,000	208,000	224,640	242,611	262,020	280,361
local	ha	557,000	564,040	566,901	573,589	579,611	580,773	574,482	563,835	551,012	535,792	522,163
Total: 3/	ha	802,000	818,040	834,401	851,089	868,111	885,473	903,182	921,245	939,670	958,463	977,633
hybrid yield kg/ha 4/		3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
composite	kg/ha	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
local fertilizer	kg/ha	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
local no fertilizer	kg/ha	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Production hybrid	MT	192,000	201,000	210,000	222,000	232,500	248,700	271,200	298,320	328,152	360,966	393,453
composite	MT	42,000	44,000	47,000	49,000	52,000	55,600	60,600	66,660	73,326	80,658	87,916
local fertilizer	MT	208,000	214,500	226,200	232,700	240,500	252,200	270,400	292,032	315,394	340,626	364,469
local no fertilizer	MT	557,000	564,040	566,901	573,589	579,611	580,773	574,482	563,835	551,012	535,792	522,163
Total:	MT	999,000	1,023,540	1,050,101	1,077,289	1,104,611	1,137,273	1,176,682	1,220,847	1,267,884	1,318,042	1,368,001
Number of Farm Families		1,149,200	1,188,273	1,228,674	1,270,449	1,313,644	1,358,308	1,404,490	1,452,243	1,501,619	1,552,674	1,605,465
Consumption per farm family kg 5/		869.3 kg =	861.4	854.7	848.0	840.9	837.3	837.8	840.7	844.4	848.9	852.1
Consumption per 90 kg bag		9.7 bags	9.6 bags	9.5 bags	9.4 bags	9.3 bags	9.3 bags	9.3 bags	9.3 bags	9.4 bags	9.4 bags	9.5 bags

---

1/ Hybrid and composite maize area is expected to increase by 5% up to 1984/85, by 7% in 1985/86, by 9% in 1986/87 and 10% until 1989/90, before it drops to 9% in 1990/91.

2/ Improved Local maize area is expected to increase by 3% up to 1984/85; by 5% in 1985/86, by 7% in 1986/87 and 8% until 1989/90, before it drops again to 7% in 1990/91.

3/ The total area in Maize is expected to increase by 2% per year until 1000,000 ha is reached in the early 1990's. By that time hybrid maize is expected to be a major contributor to maize production.

4/ Average crop husbandry practices are expected to continue at the same level as in 1980/81 thus average yields will remain for the next 10 years.

5/ Population growth is expected to reach 3.4% from 1980 to 1990.

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RICE

Table 7 ~~[illegible]~~: RICE: PRODUCTION 1/ AND EXPORTS, 1971-79

	1971	1972	1973	1974	1975	1976	1977	1978	1979
Production (Thousand Short Tons)	19.1	21.9	19.0	23.5	16.2	27.0	26.3	33.9	22.5
Exports (Thousand Short Tons)	5.7	7.9	15.9	12.3	5.7	4.8	13.3	8.5	7.7
Value of Exports (Millions of K)	0.9	1.1	2.6	3.0	1.6	1.5	2.5	2.1	2.2

1/ Marketed Production.

Source: Malawi Statistical Yearbook 1979; ADMARC and Annual Statement of External Trade, 1979

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Table SUGAR: PRODUCTION, CONSUMPTION AND EXPORTS, 1975-81

	1975	1976	1977	1978	1979	1980	1981 5/
Volume of Production 1/							
Raw Sugar	51,587	64,842	77,944	75,801	89,740	121,673	120,555
Refined Sugar	19,932	27,965	22,962	27,239	29,836	42,130	65,000
Total	71,519	92,807	100,906	103,040	119,576	163,803	185,555
Volume Sold 2/							
Raw Sugar-Local	17,084	17,881	15,070	11,842	na	na	na
Raw Sugar-Export	18,304	34,466	46,037	69,369	na	na	na
Refined Sugar-Local	17,211	19,641	25,247	24,153	na	na	na
Refined Sugar-Export	1,002	-	-	-	na	na	na
Total	53,601	71,988	86,354	105,364	na	na	na
Local Consumption 3/							
Raw Sugar	19,101	14,836	11,740	15,094	na	na	na
Refined Sugar	17,139	23,622	22,583	26,667	na	na	na
Total	36,240	38,458	34,323	41,761	42,694	44,866	48,889
Exports to EEC (Short Tons)							
Landed Weights of Sugar at EEC Ports	n.a.	22,773	23,107	22,690	24,600	16,728	21,889
Other Exports of Sugar (Short Tons) 3/							
USA	17,095	17,008	45,460	32,061	51,766 4/	87,716 4/	121,111 4/
Zambia	-	-	1,650				
Export Earnings (Km)	na	na	na	10.85	13.99	33.21	53.6

1/ Related to production year (assumed year prior to year sold).
2/ In year ending March 31 (SUCOMA Fiscal Year).
3/ Within calendar year.
4/ Exports to Free Market Areas.
5/ Estimate

Source: SUCOMA.

SUGAR

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Table 9 TEA: ACREAGES, PRODUCTION AND EXPORTS, 1960-80

Year	Acreage ('000)	Production (Kg Million)	Exports (Kg Million)	Exports (K Million)
1960	29	11.8	11.0	7.6
1961	30	14.3	13.4	8.6
1962	31	13.3	12.4	6.9
1963	32	11.9	11.2	6.5
1964	33	12.4	12.1	6.6
1965	34	13.0	13.2	7.5
1966	34	15.4	15.2	8.8
1967	35	16.8	17.0	9.0
1968	36	15.8	15.8	9.7
1969	37	16.9	17.2	9.5
1970	38	18.7	17.7	10.9
1971	38	18.6	18.2	11.9
1972	39	20.7	19.9	12.0
1973	40	23.6	22.7	13.8
1974	41	23.4	23.8	17.2
1975	42	26.2	24.9	21.7
1976	43	28.3	29.4	26.4
1977	43	31.6	29.8	41.6
1978	44	31.9	30.6	29.2
1979	44	32.6	31.1	30.7
1980	..	29.9	..	29.8

.. Not available

Source: National Statistical Office. Tea Association (Central Africa) Limited, 1979.

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LIVESTOCK

Table ~~4[illegible]~~ 10: LIVESTOCK: NUMBER BY TYPE, 1960-78

Year	Cattle				Goats	Pigs	Sheep	Donkeys	Horses
	Southern Region	Central Region	Northern Region	Total					
1960	45,702	193,223	117,752	356,677	442,622	72,470	69,098	412	82
1961	49,787	198,433	126,542	374,762	529,458	100,479	82,223	557	74
1962	52,656	200,404	127,327	380,387	493,184	105,166	77,757	398	65
1963	59,003	204,508	132,634	396,145	438,488	127,897	81,918	394	47
1964	62,989	212,921	135,509	411,419	480,295	135,395	74,139	544	44
1965	66,509	219,668	146,116	432,293	464,548	123,773	71,337	414	48
1966	71,999	228,137	149,992	450,128	626,121	142,666	88,820	486	51
1967	78,998	229,159	155,849	464,006	665,007	149,276	81,277	432	44
1968	91,147	236,299	152,470	479,916	616,961	180,234	90,280	381	67
1969	94,265	239,766	157,428	491,459	599,393	149,772	81,136	383	39
1970	98,327	229,291	163,899	491,517	639,078	146,344	121,979	429	49
1971	117,890	257,398	165,577	540,865	629,901	172,441	179,469	574	81
1972	129,271	270,333	173,301	572,905	565,580	172,333	88,516	747	68
1973	150,298	300,127	175,576	626,001	677,089	174,488	79,202	735	71
1974	151,171	311,499	189,285	651,955	694,652	150,816	79,775	770	64
1975	160,381	325,679	214,415	700,475	739,088	189,072	87,821	885	48
1976	166,752	359,289	200,900	726,941	827,612	199,515	135,238	881	37
1977	170,061	361,984	212,029	744,074	794,438	205,183	86,368	926	69
1978	201,290	370,657	217,586	789,533	655,084	174,316	78,747	707	90

Source: Department of Veterinary Services; Malawi Statistical Yearbook 1979, National Statistical Office.

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Table ~~[illegible]~~: FISH PRODUCTION, BEACH PRICES, EXPORTS AND IMPORTS, 1965-78

Year	Production (Total Malawi Waters) Volume ('000 short tons)	Production (Total Malawi Waters) Value (K'000)	Beach Price (t/lb)	Volume ('000 short tons)	Exports Value (K'000)	Imports (All types of fish) Quantity ('000 short tons)	Imports (All types of fish) Value (K'000)
1965	20.8	100.0	2.4	--	--	0.1	66.7
1966	19.3	960.0	2.5	--	--	0.2	78.0
1967	15.9	800.0	2.3	0.1	28.9	0.2	92.7
1968	20.7	1000.0	2.5	0.2	60.9	0.3	146.4
1969 1/	46.6	3731.0	4.0	0.6	188.9	0.3	152.6
1970	73.1	5552.0	3.8	0.9	300.2	0.6	218.6
1971	80.7	5166.0	3.2	1.7	350.7	0.3	182.0
1972	92.7	7044.0	3.8	1.1	467.9	0.4	210.5
1973	76.5	6114.0	4.0	1.0	538.6	0.2	156.6
1974	77.3	6198.0	4.0	1.5	654.1	0.5	462.6
1975	78.2	7940.0	5.1	3.9	1357.0	0.2	260.0
1976	82.6	7490.0	4.5	2.1	698.6	0.4	336.2
1977	75.2	6820.0	4.5	1.1	1046.0	0.1	217.6
1978	74.1	7335.0	5.0	--	765.8	0.3	466.3

1/ From 1969, fish data have been revised upwards following the findings of a Catch Assessment Survey conducted in 1974.

Source: Malawi Government - National Statistical Office
Compendium of Agricultural Statistics, 1977
Malawi Statistical Yearbook, 1979.

-- Nil or negligible
.. Not available

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Contract Paper No.6

DRAFT

The Role of Low-Resource Agriculture in Africa: Mali Supplementary Information

by

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW RESOURCE AFRICAN AGRICULTURE

MALI Supplementary Information

1. Production Statistics

a. Production of major crops and amounts marketed for these crops are shown in Table 1 for 1981/82 - 1984/85. Area and production of major crops, by region, are shown in Table 2. As these data are for 1978/79, they should only be used to illustrate the relative shares of production of different regions. Figure 1 is a map of Mali showing the allocation of area by region to agroecological zone. Figure 2 shows the location of different rural development projects in Mali.

b. Subsistence agriculture and animal production constitute the mainstay of Mali's economy, representing 30 percent of GDP and 75 percent

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of total agriculture. Mali's agriculture is affected by drought frequently as poor weather affected agriucltural production in 1983/84 and 1984/85. The livestock sector has not yet built its herd levels to the levels of 1972 (i.e. pre-1973/74 drought). Since 1982, the livestock herd has fallen by over 25 percent and is now estimated at 4.5 million head (World Bank).

c. The value of selected agricultural commodity exports and their share of total export earnings is shown in Table 3.

2. Producers

The 1976 national population census provides the basic demographic information on Mali. A new census is scheduled for December 1986. The FAO-published study by Jennie Day (which is referenced in the Senegal country write-up) showed that in 1970 48 percent of women in Mali were in the agricultural labor force, while 92.1 percent of economically active women were in the agricultural sector.

There are numerous micro-level village studies which focus on cropping activities and labor utilization. We provide information from one of these studies to illustrate the type of data available at this level of disaggregation. The study is an M.S. thesis by Allen Fleming at Purdue and was completed in 1981. The thesis title is "Agricultural Production and the Use of Labor in Alternative Enterprises in the Circle of Kita, Mali." Kita is in the Kayes region.

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Data were collected from 90 households in 3 vilages in the area. Final analysis was done on 55 households in 2 villages. The division of labor by crop and gender for the 2 vilages is shown in Table 4. Details on the extent of specific operations undertaken by gender are shown for peanuts and millet/sorghum in Tables 5 and 6 respectively. The distribution of labor utilized on personal and communal fields, by gender, is shown in Table 7, while female labor use by operation and crop on communal fields is shown in Table 8. Data similar to Table 8, but for personal fields, is shown in Table 9.

A comparison on nonagricultural related work activities for males and females is shown in Tables 10 and 11.

Sources of income and income per adult are shown in Tables 12 and 13. There are no data on distribution of income by gender.

3. Method of Production

a. Irrigated/rainfed

Irrigated production is principally found in three areas: (1) about 50,000 ha of irrigated land lies in the Office du Niger gravity flow irrigation command area where rice and sugarcane are the important crops; (2) another 35,000 ha of paryially controlled flood irrigation comprise the so-called "operations" of rice-Segou and rice-Mopti; (3) finally, the seasonally flooded Niger floodplain is used for crop production on about 110,000 ha.

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b. Types and amounts of commercial inputs

The major areas in which commercial inputs are utilized are the Office du Niger area and the southern cotton-growing area known as the CMDT project area. In the former fertilizer is used on rice and sugarcane and in the latter fertilizer, herbicides, fungicides, and insecticides are distributed to farmers for cotton growing. In 1984 the Office du Niger accounted for nearly 3,500 tons of fertilizer on 39,000 ha of rice and 2,700 ha of sugarcane.

c. Intercropping/monocropping

Intercropping is very prevalent in Mali with cereal/legume intercrops predominating. Some common examples are sorghum/millet, sorghum/millet/cowpeas, maize/cowpeas, and millet/sorghum/groundnuts.

4. Consumption and Storage.

There are no estimates on onfarm storage but government held modern stroage capacity is estimated at 59,000 m. tons.

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Table 1. Mali: Agricultural Production, Marketing, and Official Producer Prices, 1981/82-1985/86

	1981/82	1982/83	1983/84	1984/85	1985/86 Proj.
Production			(In thousands of metric tons)		
Cotton	97.7	128.0	141.0	144.7	183.0
Groundnuts	97.8	48.3	26.3	37.6	51.0
Millet/sorghum/maize	930.8	888.7	745.1	594.8	991.0
Rice paddy	175.6	129.7	129.2	103.4	180.0
Marketing					
Cotton	96.5	127.6	140.7	144.2	180.0
Groundnuts	14.5	10.3	--	--	--
Millet/sorghum/maize	16.6	18.2	3.7	3.6	21.3
Rice paddy	58.9	53.2	55.9	54.7	62.6
Official producer prices			(In CFA francs per kg) 1/		
Cotton	65.0	65.0	75.0	75.0	84.65
Groundnuts	45.0	45.0	--	--	--
Millet/sorghum	42.5	45.0	50.0	50.0	55.0
Maize	45.0	47.5	50.0	50.0	55.0
Rice paddy	50.0	55.0	60.0	65.0	70.0

Sources: Ministry of Agriculture, Annual Report 1984/85; and data provided by the Malian authorities.

1/ The crop year is April/March, while the marketing year is November/October.

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TABLE 2

?

II - E N Q U E T E   A G R I C O L E

REPARTITION DE LA POPULATION BRUTE DES PRINCIPALES CULTURES PURES (PAR LES EXPLOITATIONS AGRICOLES) ET DES RENDEMENTS DES MEMES CULTURES PAR REGION CAMPAGNE 1978-79

SOURCE : D.N.S.I.

V/T

UNITE : Production : Tonnes
Rendement : KG/HA

REGIONS / CULTURES		KAYES	BAMAKO	SIKASSO	SEGOU	MOPTI	GAO	ENSEMBLE	COMP. 1977/ (ENSE
MIL	Production	18.080,9	49.266,3	39.630,4	296.387,0	148.130,3	618,6	552.107,5	52
	Rendement	1.122,53	1.018,95	999,30	1.044,54	667,34	77,6	///	[illegible]
SORGHO	Production	98.941,2	64.555,2	59.560,6	111.222,7	21.759,2	1.875,2	358.112,1	45
	Rendement	966,45	779,39	846,30	1.132,55	523,37	419,02	///	[illegible]
RIZ PADDY	Production	1.153,3	5.883,8	12.705,6	93.118,1	33.547,5	11.883,1	158.291,6	[illegible]
	Rendement	1.138,34	2.018,74	1.024,50	-	707,20	943,87	///	[illegible]
FONIO	Production	1.148,4	1.299,[illegible]	14.723,0	19.965,0	1.971,6	-	39.107,0	51
	Rendement	559,80	975,00	659,10	606,45	441,11	-	///	[illegible]
ARACHIDE COQUE	Production	54.429,2	36.530,7	21.866,8	50.511,6	1.020,[illegible]	-	161.358,3	17
	Rendement	870,63	967,80	735,80	1.020,39	304,24	-	///	[illegible]
COTON	Production	33,59	35.740,9 (2)	82.666,7 (2)	9.331,3 (2)	110,7	-	128.185,5	[illegible]
GRAINE seed	Rendement	-	1.126,90 (1)	1.114,7 (1)	[illegible]20,1 (1)	108,00	-	///	[illegible]
MAIS	Production	10.241,1	19.141,7	68.018,5	5.705,7	-	-	103.110,0	11
GRAINE seed	Rendement	494,49	1.752,00	1.084,50	1.423,47	-	-	///	[illegible]

(1) - Rendement C.M.D.T.

(1) - Non compris C.A. , C.A.R. et Fermes d'Etat

(2) - Production des C.A. et Production commercialisée de la C.M.D.T.

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ENQUETE AGRICOLE

Annuaire Statistique du Mali 1979

DISTRIBUTION DES PARCELLES ET DE LEURS SUPERFICIES SELON LA CULTURE PORTEE

CAMPAGNE 1978 - 1979

OURCE : D.N.S.I.

XP.PARCELL. ULTURES	NOMBRE DE PARCEL.	SUPERFI.CULTIV. (HA HA	TAIL.MOYEN.D'UNE PARCELLL	% EN PARCELLE	% EN SUPERFIC
Mil	370.242	410.996	1,1	19,3	23,4
Sorgho	274.461	387.193	1,4	14,3	22,0
Riz	124.352	148.121	1,2	6,5	8,4
Fonio	81.895	62.941	0,8	10,7	3,6
Arachide	251.992	138.306	0,5	13,1	7,9
Coton	84.883	42.826	0,5	4,4	2,3
Maïs	128.894	46.832	0,4	6,7	2,7
Autres cultures	479.955	519.924	0,1	25,0	29,6
TOTAL	1.796.674	1.757.139		100,0	100,0

REPARTITION DES SUPERFICIES CULTIVEES DES EXPLOITATIONS AGRICOLES PAR CULTURE ET PAR REGION CAMPAGNE 1978-79

Area by REGION

UNITE : Hectare ✓

SOURCE : D.N.S.I.

REGION CULTURES	KAYES	BAMAKO	SIKASSO	SEGOU	MOPTI	G A O	ENSEMBLE
Mil	15.068,1	39.473,3	22.284,8	274.641,6	216.461,7	7.971,1	575.900
Sorgho	98.176,8	58.631,0	48.464,3	94.507,8	34.610,5	4.475,1	338.865
Riz	1.013,3	2.931,3	11.919,4	35.783,7	47.437,1	12.589,8	111.574
Fonio	3.191,8	1.332,3	12.406,9	32.921,8	4.469,7	-	54.322
Arachide	50.526,9	17.622,9	14.163,9	48.681,7	3.352,7	-	134.348
Coton	-	17.877,0	70.098,1	16.568,8	1.020,1	-	105.564
Maïs	13.585,2	6.858,3	16.321,6	3.670,5	2.185,2	193,2	42.811
Autres cultures pures	144,0	437,0	15.983,2	3.974,8	492,3	325,0	21.356
Maïs - Mil	-	1.400,9	27.266,5	277,2	165,4	-	29.110
Maïs - Sorgho	2.460,3	4.952,3	22.555,3	1.559,5	209,6	-	31.737
Maïs - Arachide	1.407,1	4.563,8	3.305,8	253,5	3,9	-	9.534
Mil- Haricot	241,7	18.304,5	33.289,5	-	-	372,7	52.208
Mil - Arachide	231,6	945,6	1.500,8	-	-	-	2.678
Mil - Sorgho	4.669,8	12.842,4	3.890,1	11.740,7	15.348,0	83,0	48.571
Sorgho - Arachide	9.527,5	6.022,9	3.208,0	-	36,6	-	18.845
Sorgho - Haricot	224,4	44.875,5	111.198,1	141,7	19,7	-	156.459

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TABLE 2.

- continued -

II - ENQUETE AGRICOLE

REPARTITION DES SUPERFICIES CULTIVEES [illegible] AGRICOLES [illegible] ET PAR REGION

SOURCE : D.N.S.I. (suite) CAMPAGNE 1978-1979 UNITE : Hectare

REGION CULTURES	KAYES	BAMAKO	SIKASSO	SEGOU	MOPTI	GAO	ENSEMBL
Autres associations	2.020,1	13.354,7	40.070,2	2.274,4	416,8	2.935,1	61.0
TOTAL 1978-79	202.488,6	252.425,7	457.926,0	526.997,7	326.279,3	28.945,0	1.795.0
TOTAL CAMPAGNE 1977-78	300.472	258.080	450.942	476.052	365.746	52.178	1.903.4
1978-79 EN % DE 77/78	67,4	97,8	101,6	110,7	89,2	55,5	

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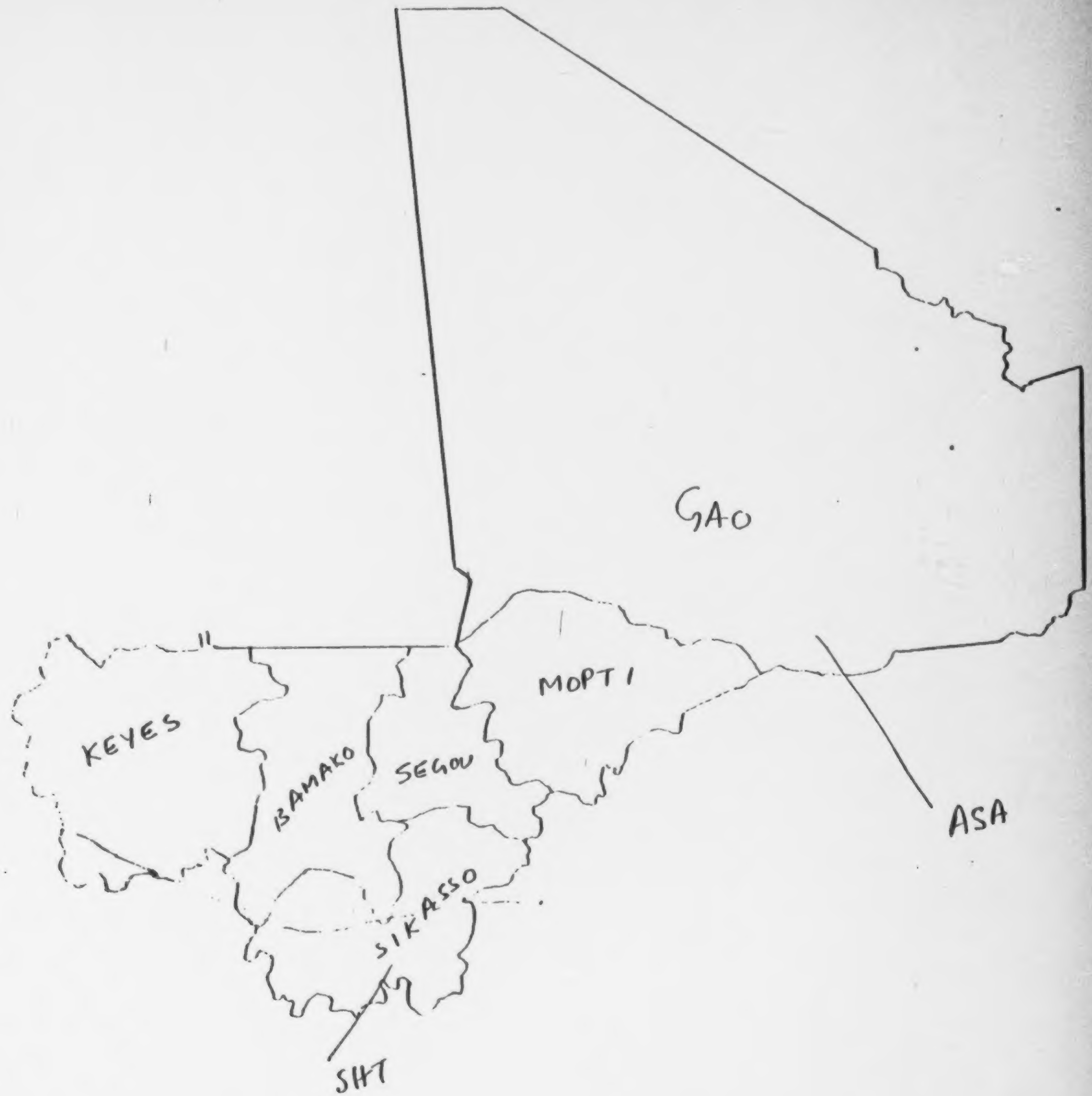
GAO
MOPTI
KEYES
BAMAKO
SEGOU
SIKASSO
ASA
SHT

Figure 2

SITUATION DES OPERATIONS DE DÉVELOPPEMENT RURAL
(d'après la BIRD)

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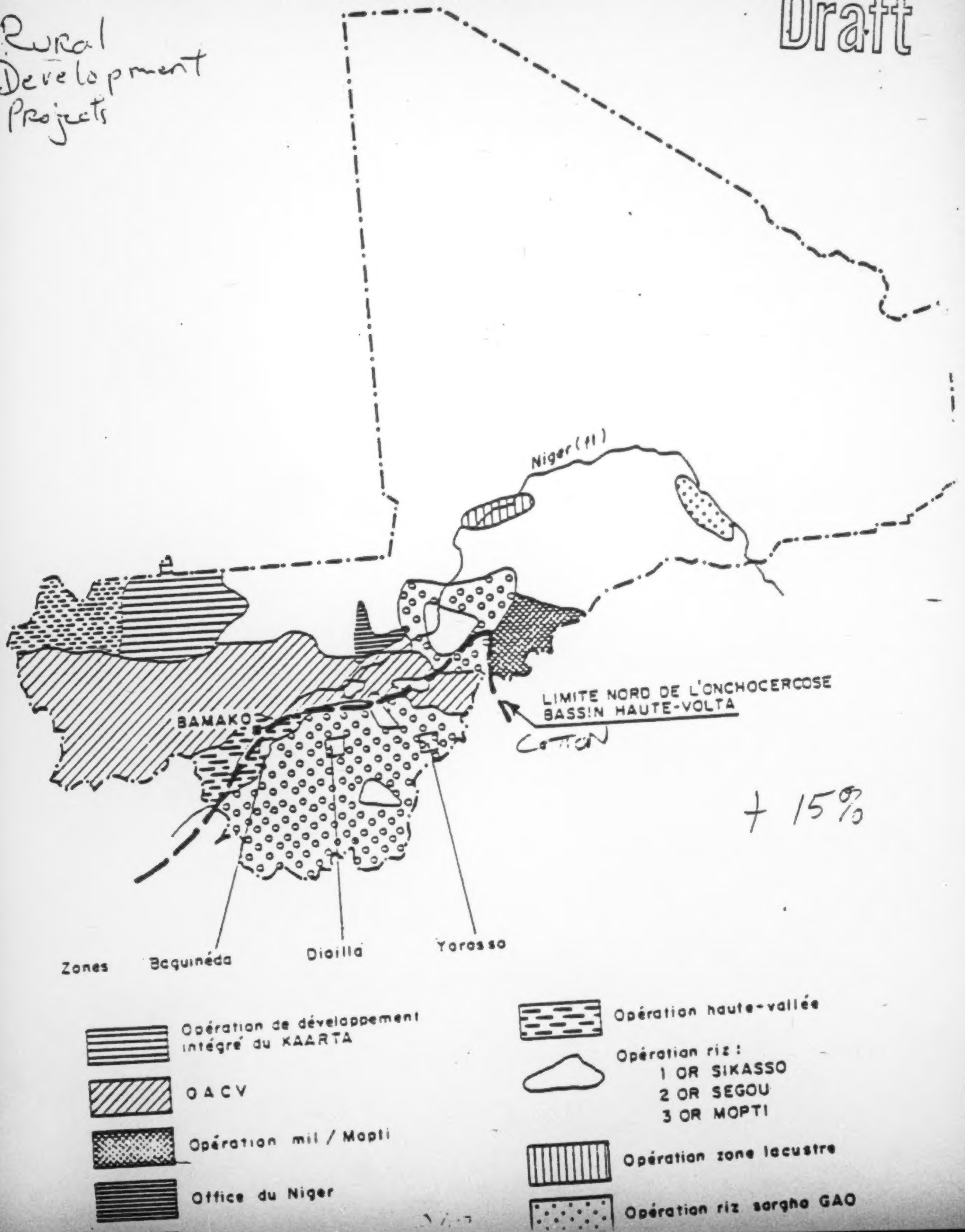
Rural Development Projects



Niger (fl)
BAMAKO
LIMITE NORD DE L'ONCHOCERCOSE BASSIN HAUTE-VOLTA
Cotton
Zones
Bcquinéda
Dioilla
Yorosso
Opération de développement intégré du KAARTA
OACV
Opération mil / Mopti
Office du Niger
Opération haute-vallée
Opération riz :
1 OR SIKASSO
2 OR SEGOU
3 OR MOPTI
Opération zone lacustre
Opération riz sorgho GAO

+ 15%

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Table 3. Mali: Composition of Exports, f.o.b., 1981-84

(Value in billions of CFAF; volume in metric tons;
unit value in CFAF per kilo)

	1981	1982	1983	1984 Prov.
Cotton				
Value	17.1	18.5	28.1	41.9
Cotton fiber				
Value	14.3	17.0	25.9	38.7
Volume	37,335	35,870	47,130	51,600
Unit value	383	474	550	750
Cotton seeds				
Value	—	0.3	—	—
Volume	—	5,500	—	—
Unit Value	—	50	—	—
Cotton cakes				
Value	—	0.2	0.9	0.7
Volume	—	2,873	12,246	9,100
Unit Value	—	65	70	75
Cotton threads and materials				
Value	0.8	0.7	1.2	2.0
Volume	3,000	2,545	3,576	4,370
Unit value	250	275	336	460
Cotton oil				
Value	—	0.4	0.1	0.5
Volume	—	2,000	628	2,000
Unit value	—	175	225	250
Groundnuts				
Value	2.5	0.9	0.7	0.5
Shelled groundnuts				
Value	—	—	0.5	0.5
Volume	—	—	5,000	5,000
Unit value	—	—	101	101
Groundnut oil				
Value	2.0	0.6	0.1	—
Volume	6,965	2,743	508	—
Unit value	280	226	225	—
Groundnut cakes				
Value	0.5	0.3	0.1	—
Volume	8,564	4,728	1,058	—
Unit value	59	55	65	—
Hides and leather				
Value	0.5	0.6	0.7	0.7
Volume	667	700	800	750
Unit value	900	838	900	900
Livestock				
Value	14.0	17.1	21.3	21.3
Volume	35,253	37,900	42,500	37,000
Unit value	396	450	500	575
Fish				
Value	0.6	0.7	1.6	0.7
Volume	2,000	2,400	2,886	1,240
Unit value	300	306	550	550
Gum arabic				
Value	0.2	0.2	0.4	0.4
Volume	800	800	1,000	1,100
Unit value	300	300	400	400
Basket and esparto products				
Value	0.1	0.2	0.2	0.2
Volume	1,100	1,300	1,400	1,400
Unit value	125	138	150	150
Sheanuts				
Value	1.6	2.1	0.8	1.3
Volume	25,000	18,000	7,000	12,000
Unit value	62	115	115	110
Sheanut oil				
Value	—	0.2	0.5	2.0
Volume	—	646	1,400	4,340
Unit value	—	350	375	450
Miscellaneous				
Value	5.3	7.1	8.6	10.0
Total value	41.8	47.6	63.0	79.0

Sources: Estimates prepared by the BCEAO; and staff estimates.

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4

Table [redacted]. The Division of Labor by Crop for Adult Males and Females of Senko and Namala.

	All Adult Males		All Adult Females	
	Hours Per Household	Percent	Hours Per Household	Percent
		Senko		
Peanuts	954	32	533	53
Sorghum/Millet	1,486	49	124	12
Corn	209	7	64	6
Rice	5	0	61	6
Okra	5	0	89	9
. . .				
All Crops	3,014	100%	1,001	100%
		Namala		
Peanuts	1,861	54	1,532	60
Sorghum/Millet	1,197	34	311	12
Corn	81	2	74	3
Rice	99	3	347	14
Okra	0	0	0	0
. . .				
All Crops	3,470	100%	2,549	100%

Note: Most of the remaining hours for all persons were spent early in the season before the crop was planted on each field. It is likely that most of this additional time was on subsequent peanut, millet and sorghum fields.

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Table ~~5.8~~. 4 (cont'd) The Agricultural Labor Input of Sex-Age Groups: Mean and Median Hours, Standard Errors and Number of Persons, in Senko and Namala.

	Males of Age:				Females of Age:				All Persons Over 8
	All Over 8	8-12	13-65 (Adult)	Over 65	All Over 8	8-12	13-65 (Adult)	Over 65	
					Senko				
Mean hours	577	171	694	404	170	5	216	43	372
Median hours	660	53	825	255	89	14	191	5	250
Standard error	31.02	41.43	31.67	165.71	14.46	2.89	16.38	40.06	20.43
Number	159	33	121	5	162	32	126	4	321
					Namala				
Mean hours	727	470	830	261	368	111	420	75	524
Median hours	833	447	892	72	372	60	450	75	504
Standard error	30.48	69.03	28.28	210.19	15.73	23.25	15.31	10.50	18.68
Number	145	35	106	4	189	30	157	2	334

Note: Only the labor of permanent residents on the fields of sampled households is included.

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4(cont'd)

Table ~~9-6~~. Percentage of Work on the Major Crops Done by Sex-Age Groups and Outside Labor in Senko and Namala.

Labor Source	Senko Peanuts	Senko Sorghum/Millet	Senko All Crops	Namala Peanuts	Namala Sorghum/Millet	Namala All Crops
Child under 8	0	0	0	0	1	1
Males 8-12	3	4	4	9	6	7
13-65	50	63	56	43	44	41
Over 65	1	1	1	0	0	0
All Males	54	68	61	52	50	48
Females 8-12	0	0	0	1	1	2
13-65	28	5	19	35	11	30
Over 65	0	0	0	0	0	0
All Females	28	5	19	36	12	32
Outside Labor	17	26	20	11	37	19
Total	99%	99%	100%	99%	100%	100%

Note: Sex-age groups are from within the sampled households while outside labor includes all types of nonhousehold labor. Only on-farm labor (sampled households) is included.

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Table 5.1[illegible]. Percent of Peanut Operations Performed by Males and Females.[a]

	Senko		Namala	
Operation	Percent Male	Percent Female	Percent Male	Percent Female
Clearing/cleaning	95	5	75	25
Hoe tillage	35	65	27	73
Plowing	100	0	98	2
Hand seeding	67	33	47	53
Seeding with seeder	100	0	97	3
Hoe weeding	66	34	57	43
Weeding with multiculteur	—	—	100	0
Harvesting	76	24	61	39
Threshing + winnowing	48	52	56	44
Transport with animals	96	4	100	0
Harvesting with lifter	—	—	100	0
Other	46	54	88	12
All Operations	66%	34%	59%	41%

[a] Includes only household members over eight years old.

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Table 6. Percent of Sorghum/Millet Operations Performed by Males and Females.[a]

	Senko		Namala	
Operation	Percent Male	Percent Female	Percent Male	Percent Female
Clearing/cleaning	100	0	100	0
Hoe tillage	97	2	94	6
Plowing	99	1	99	1
Hand seeding	97	3	95	5
Seeding with seeder	100	0	100	0
Hoe weeding	99	1	95	5
Weeding with multiculteur	—	—	100	0
Harvesting	63	37	62	38
Threshing + winnowing	42	58	53	47
Transport with animals	94	5	99	1
Other	99	0	92	8
All Operations	93%	7%	80%	20%

[a] Includes only household members over eight years old.

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Table ~~[illegible]~~. Total Farm Labor Hours Per Household by Selected Subgroups and the Proportion of That Time Spent on Communal Fields.

	Senko		Namala	
Subgroup	Hours	Percent Communal	Hours	Percent Communal
Boys 8-12	195	80	628	70
Male adults	3,014	67	3,470	68
All males - 8 or older	3,279	68	4,138	68
Girls 8-12	6	61	132	45
Female adults	1,001	24	2,549	27
All females - 8 or older	1,013	23	2,687	28
Outside labor	1,063	70	1,572	72
All persons	5,365	60%	8,469	56%

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Table 8. Female Labor as a Percent of Total Labor[a] Utilized for Crop-Operations on Communal Fields.

Operation	Crop Sorghum/Millet	 Peanuts	 Corn
		Senko	
Hoe tillage	1	11	2
Hand seeding	3	7	2
Hoe weeding	0	3	21
Harvesting	13	9	30
Threshing/winnowing	11	36	—
All Operations	5%	9%	24%
		Namala	
Hoe tillage	5	18	0
Hand seeding	2	8	9
Hoe weeding	2	4	19
Harvesting	18	28	43
Threshing/winnowing	16	44	18
All Operations	10%	22%	26%

[a] Includes outside labor groups.

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Table ~~5~~ 9. Female Labor as a Percent of Total Labor[a] Utilized for Crop-operations on all Personal Fields.

Operation	Crop Sorghum/Millet	 Peanuts	 Corn	 Rice
		Senko		
Hoe tillage	9	83	—	99
Hand seeding	2	69	0	93
Hoe weeding	2	70	8	99
Harvesting	14	13	14	50
Threshing/winnowing	22	54	—	94
All Operations	7%	47%	8%	92%
		Namala		
Hoe tillage	19	89	95	97
Hand seeding	61	81	89	94
Hoe weeding	33	79	56	93
Harvesting	19	24	44	41
Threshing/winnowing	32	43	—	67
All Operations	25%	51%	51%	73%

[a] Includes outside labor groups.

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Table ~~[illegible]~~. The Nonagricultural Activities (and Off-Farm Exchange Labor) of Adults[a] Females in Small, Medium and Large Households (in Hours per Person).

	Household Size		
Activity	Small Households	Medium Households	Large Households
Cooking	347	163	96
Housekeeping	30	19	12
Grain pounding	120	93	86
Drawing water	65	42	33
Childcare	9	8	1
Collecting firewood	65	50	33
Laundering	104	61	42
Subtotal: Daily Domestic Chores	740	436	303
Milking and care of livestock	9	13	—
Fishing	19	13	9
Processing cotton	32	34	33
Potting	—	7	3
Making shea nut butter	8	10	9
Soapmaking	6	6	4
Other[b]	14	13	9
Subtotal: Tasks with Income Potential	88	96	67
Off-Farm Exchange Labor	20	20	11
GRAND TOTAL	848	552	381

[a] Only adults who are permanent residents are considered.

[b] Includes (among other activities): storage bin construction, plastering, food/herb gathering, preparation of processed foods, sewing, marketing and other craft activities. These are included in the second subtotal because the majority have the potential of providing cash income.

Household Size

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Table 11. The Nonagricultural Activities (and Off-Farm Exchange Labor) of Adult[a] Males in Small, Medium and Large Households (in Hours per Person).

Activity	Household Size		
	Small Households	Medium Households	Large Households
Salaried labor	11	—	4
Hunting	4	4	—
Fishing	3	4	1
Milking and care of livestock	19	12	—
Blacksmithing	—	—	3
Tailoring	14	—	1
Petty trade	7	1	—
Weaving	4	1	—
Basket and mat making	5	2	1
Ropemaking	6	3	1
Subtotal: Tasks with Income Potential	73	27	11
"Female" domestic chores	17	3	1
Construction	19	16	27
Off-farm exchange labor	48	58	26
Other[b]	2	3	2
GRAND TOTAL	159	107	67

[a] Only adults who are permanent residents are considered.

[b] Includes both domestic tasks and those having income-earning potential.

Contract Paper No. 7

DRAFT

The Role of Low-Resource Agriculture in Africa: Nigeria: Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW-RESOURCE AFRICAN AGRICULTURE

NIGERIA Supplementary Information

1. Production Statistics

a. As indicated in our earlier discussion on aggregate agricultural statistics, there is a high degree of variability attached to Nigerian data. An indicator of the divergence in data can be seen in Figures 1A and 1B, which plot USDA, FAO, and Nigerian Government production data for sorghum, millet, wheat, rice, maize, cassava, and yams. Figure 2 is a map of administrative regions and Figure 3 is a map of agroecological zones in Nigeria. Due to the discrepancies in the various sources of agricultural production data, we attempted to estimate these statistics using a bottom up approach, where we could use production estimates

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generated by the World Bank rural development projects to generate state- wide data. This was, however, unsuccessful due to problems connected with the quality and coverage of the data. Table 1 shows estimates of production for selected crops and project areas by state. Subsequently, we received area and production estimates for major crops by state. We have shown this in Table 2, but advise caution in its use due to unreliability of the Federal Office of Statistics data as seen in Figures 1A and 1B. These data could, however, be used to illustrate the relative importance of various crops, by state.

b. With increases in petroleum production and exports in the 1970's, agriuclture's share of GDP has been estimated at 23 percent for 1981. Nigerian agriculture is predominantly smallholder agriculture. Estimates of average farm size are shown in Table 3, which consists of data from the Federal Office of Statistics.

c. Nigeria, once a major exporter of agricultural commodities in Africa, has become a net importer of agricultural commodities as seen in Table 4 which shows the composition of Nigerian agricultural trade for selected years from 1960-1984. (This table is from the publication "Nigeria: An Export Market Profile," by Carl Mabbs-Zeno, USDA, ERS, IED, April 1986.)

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2. Producers

Data on producers come from various sources.

a. Dr. Tomilayo Adeyokunnu of the University of Ibadan conducted a survey on "Women in Agriculture in Nigeria" which was published by UNECA in 1981. In this survey, she attempted to ascertain differences in occupational tasks and sources of income in 3 broad regions in the country, namely the North, West, and East. These regions broadly follow the 3 major ethnic groupings in Nigeria, but it must be remembered that there are numerous other ethnic groups in the country that may have cultural practices different from these three.

Table 5 shows the distribution of women's main occupation outside the home. Table 6 shows the relative importance of crops grown, while food crops sold is seen in Table 7. Estimates of average per capita income are shown in Table 8.

b. The Federal Office of Statistics data are also shown to provide information on producers. Table 9 shows the distribution of cultivated land by tenure by state. We have included the section on farm labor which describes the age, sex distribution, employment status, and wage rates. Average household size by farming activity and state is shown in Table 10.

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c. In addition to the above 2 sources of information on producers, there are numerous micro-level studies in Nigeria which range from David Norman's famous Zaria studies to Emmy Simmons' study of the same three Zaria villages to Peter Matlon's village studies in Kano state. Part of the problem in utilizing data from these studies is related to the date of field work, i.e. from 1966-67 to 1973-74. Not only has the agricultural economy of the country changed over the ensuing period, but Northern Nigeria has become a center of rural development activities through World Bank projects which has led to changes in cropping patterns and source as well as distribution of incomes. There are on-going studies at the Centre for Socio-Economic Research, Ahmadu Bello University, which focus on the impact of agricultural development on women in different states of Nigeria. We do not have access to results from these studies as they are not in final form. Similar research is taking place at the University of Nsukka in Eastern Nigeria and the University of Ibadan.

d. The World Bank through its various agricultural development projects in Nigeria attempted to collect data on profiles of agricultural producers in different states. Some of these data on distribution of households by crops grown are shown in Tables 11.1 - 12.4. We would urge caution in attempting to extrapolate from these data due to problems in the methodology of data collection and processing.

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3. Method of Production

a. Irrigated/rainfed

While large-scale modern irrigation projects exist in Nigeria, their combined area under production is less than 100,000 ha. There are, however, small-scale indigenous irrigated farms on riverine swampland and seasonally flooded land which cover an approximate area of 800,000 ha. In the last three years an increase has taken place in the use of tubewells and diesel-powered small pumps. The World Bank estimates that 10,000 of these pumps were installed in Kano state in the last three years. But, in spite of these increases in irrigated area, Nigerian agriculture is dominated by rainfed methods of production, with over 3.0 million ha.

b. Types and amounts of commercial inputs

In 1985, over 700,000 tons of commercial fertilizer was used in Nigeria, mostly in the North. Table 13_ shows the extent of fertilizer use by crop and agricultural development project. Further data of yields of major crops with and without fertilizer by project and the extent of its use are shown in Tables 14.1-14.15.

c. Intercropping/monocropping

Intercropping is predominant in Nigeria, even among cash crops. The types of intercrops found varies by zone and region in the country. Intercrops of complex and numerous combinations can be found all over Nigeria. Variability in yields by sole/intercrop is shown in Tables 15.1-15.9 for major food crops.

d. Livestock

Livestock is a major component of agricultural production in Nigeria and is predominantly under low-resource conditions. While livestock data are suspect, we are including a section on livestock production from the Federal Office of Statistics reports which details livestock data by type of livestock.

4. Consumption and Storage

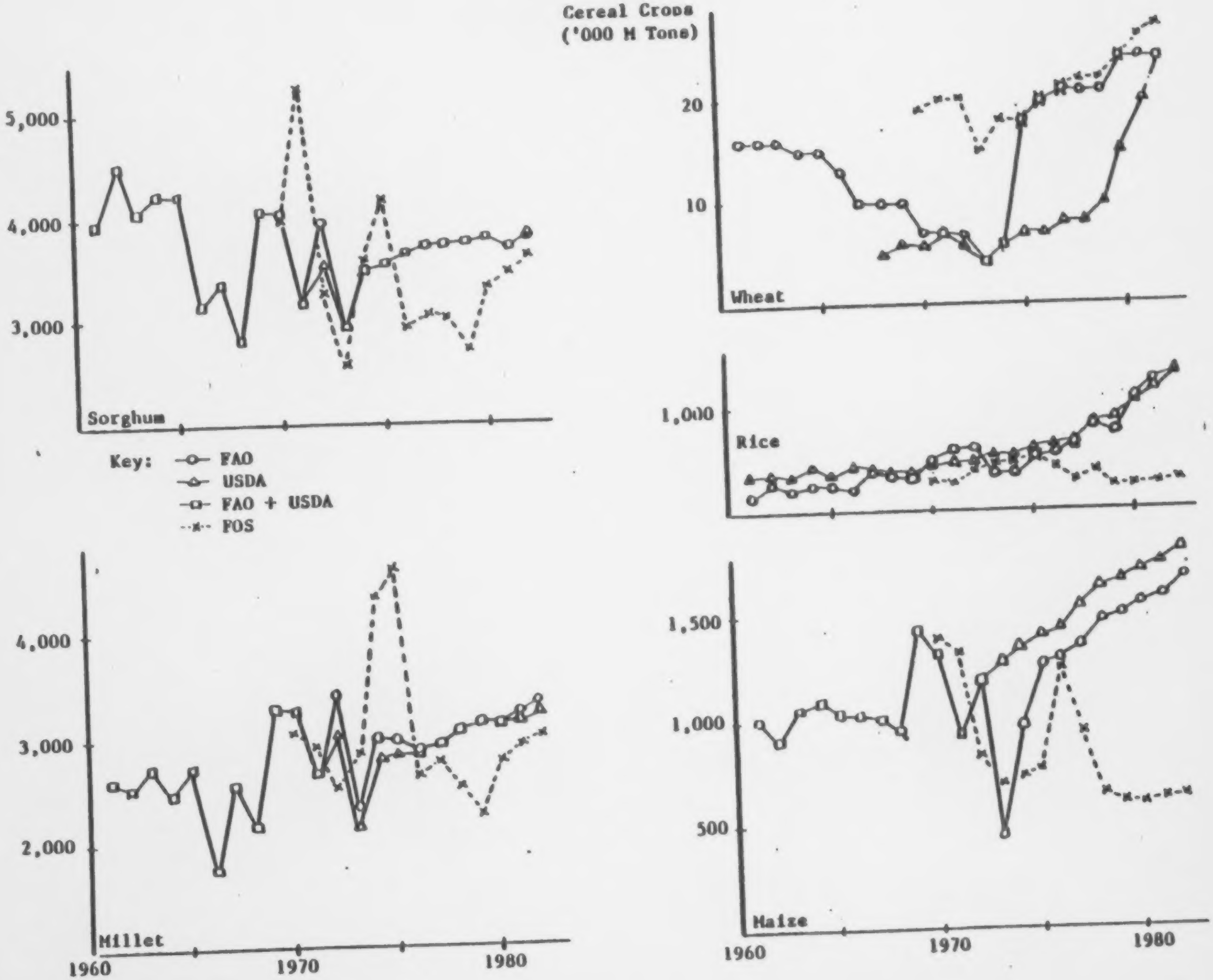
Changes have been taking place in consumption patterns in Nigeria as seen in increasing imports of wheat, rice, and maize. See Table 4 on composition of Nigerian imports. These imports are forecast to continue as Nigeria will not be able to produce sufficient quantities of wheat and rice to meet domestic requirements.

While estimates exist of on-farm storage availability, these are based on village surveys and no detailed national surveys. The Government through the Grains Board does have modern storage facilities. But the actual capacity of these is not currently known.

NIGERIA

Fig. ~~Chart~~ IA

TRENDS IN PRODUCTION



Source: Table 1

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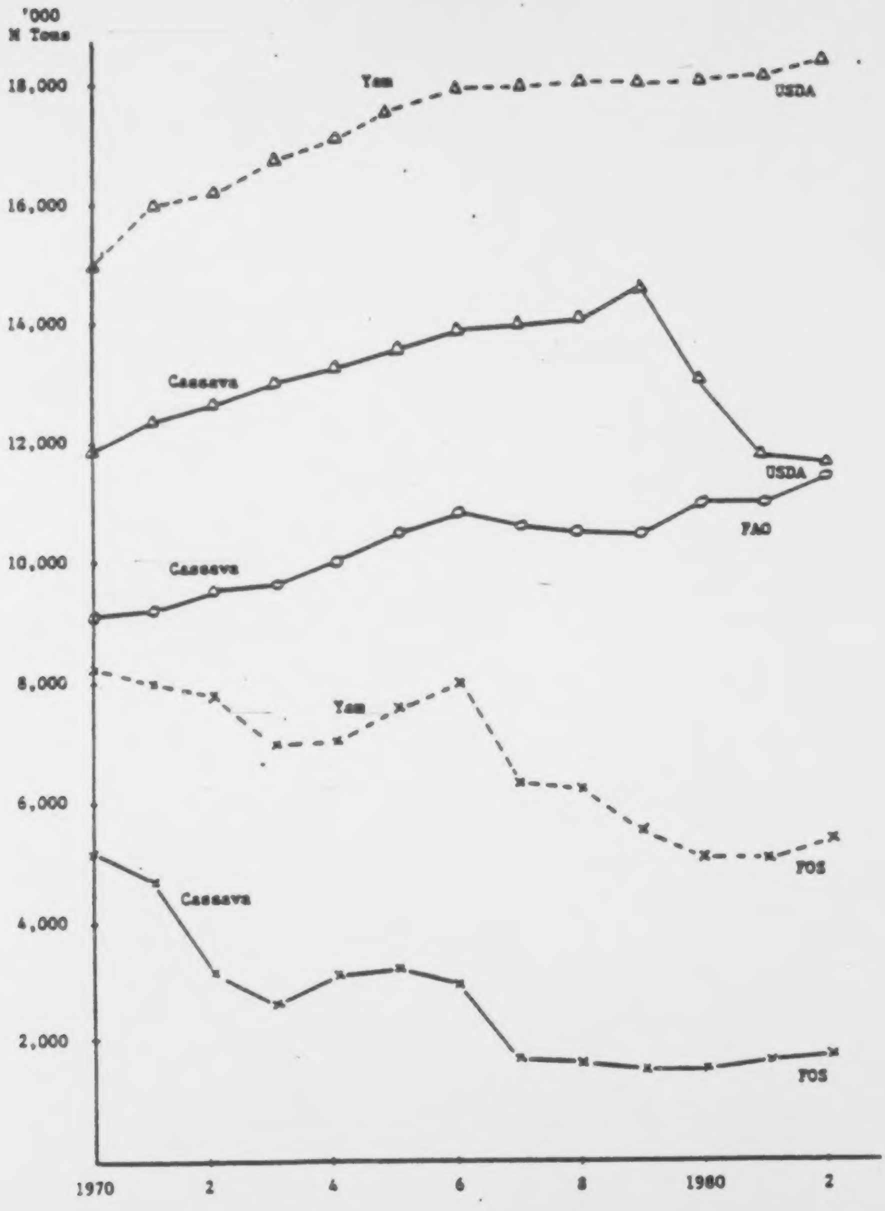
NIGERIA

FIGURE [illegible] IB

TRENDS IN PRODUCTION

Cassava, Yam



Source: Table 1

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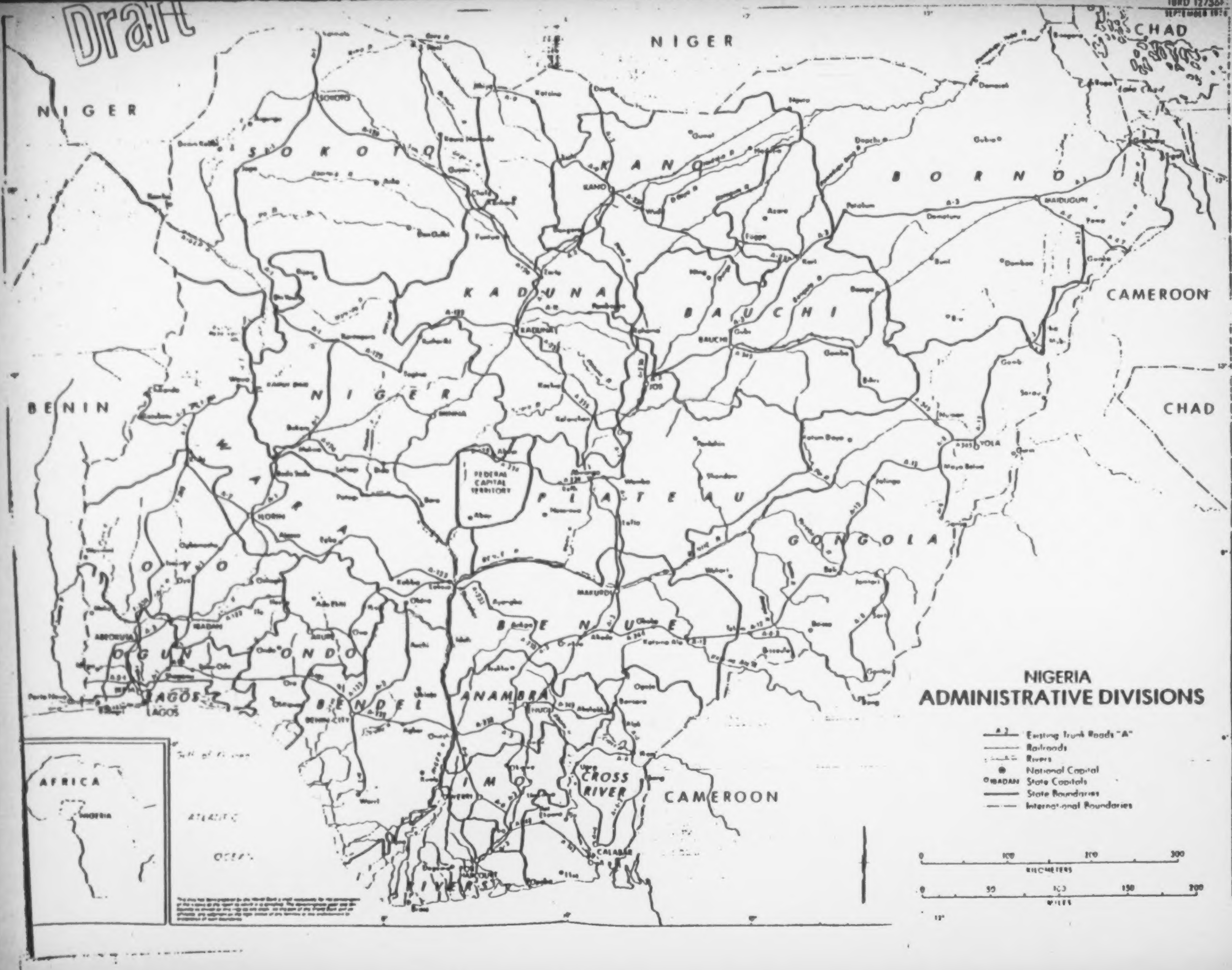
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IBRD 12736F
SEPTEMBER 1976
NIGER
NIGER
CHAD
BENIN
CAMEROON
CHAD
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SOKOTO
KANO
BORNO
KADUNA
BAUCHI
NIGER
KWARA
OYO
OGUN
LAGOS
ONDO
BENDEL
PLATEAU
GONGOLA
BENUE
ANAMBRA
IMO
RIVERS
CROSS RIVER
FEDERAL CAPITAL TERRITORY
KANO
KADUNA
BAUCHI
JOS
MAIDUGURI
YOLA
MAKURDI
ILORIN
IBADAN
ABEOKUTA
LAGOS
AKURE
BENIN CITY
ENUGU
OWERRI
PORT HARCOURT
CALABAR
SOKOTO
MINNA
Lake Chad
Bight of Guinea
ATLANTIC OCEAN
AFRICA
NIGERIA
Existing Trunk Roads "A"
Railroads
Rivers
National Capital
IBADAN State Capitals
State Boundaries
International Boundaries
0 100 200 300 KILOMETERS
0 50 100 150 200 MILES

NIGERIA
ADMINISTRATIVE DIVISIONS

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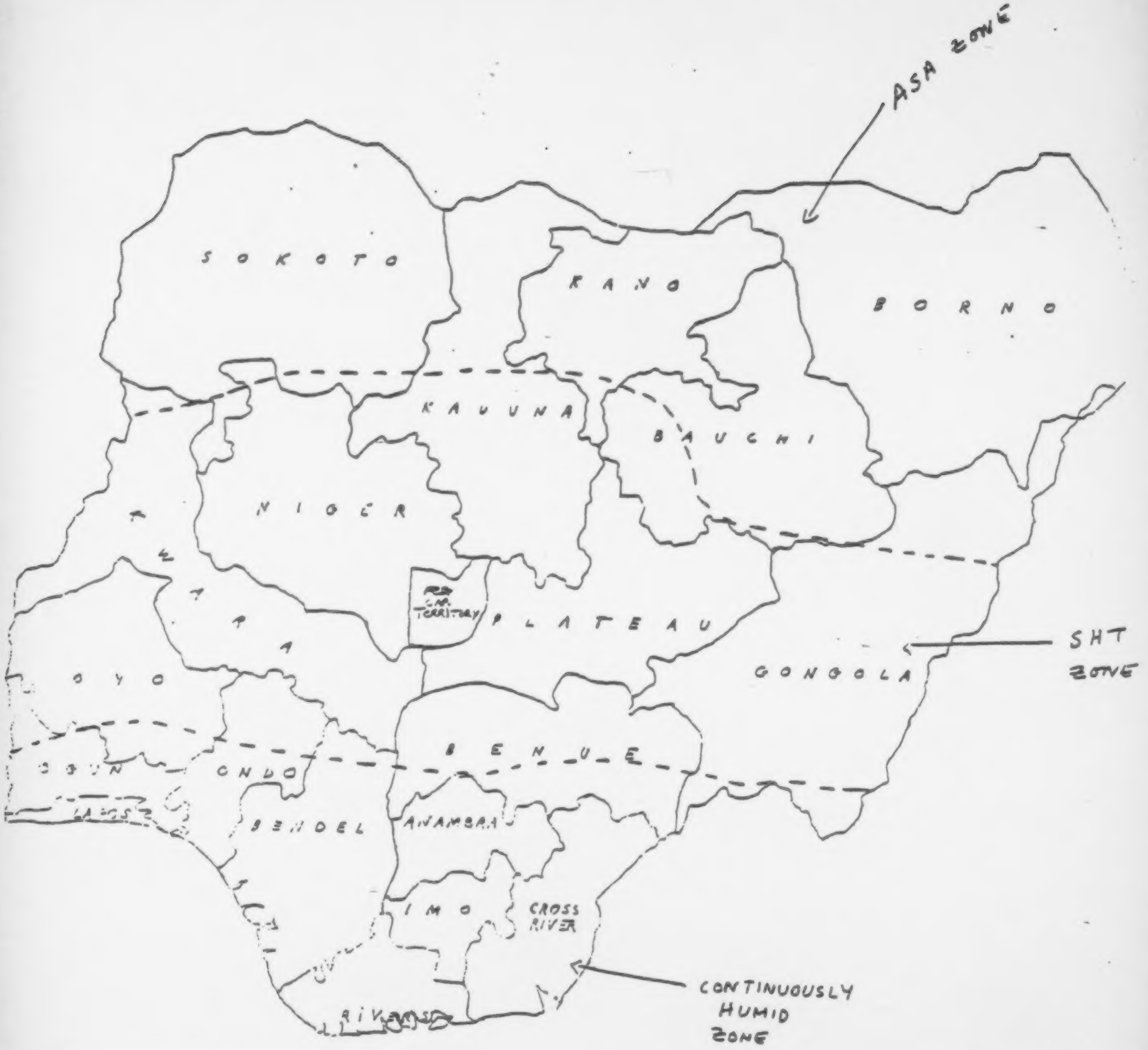
FIGURE 3: NIGERIA: AGROECOLOGICAL ZONES


ASA ZONE
SOKOTO
KANO
BORNO
KADUNA
BAUCHI
NIGER
KWARA
FED. CAP. TERRITORY
PLATEAU
SHT ZONE
OYO
GONGOLA
OGUN
ONDO
BENUE
LAGOS
BENDEL
ANAMBRA
IMO
CROSS RIVER
RIVERS
CONTINUOUSLY HUMID ZONE

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State	Sokoto	Kaduna	Kano (2)			Bauchi		Borno	Niger	Plateau	Kwara	Oyo	Ogun	Ondo	Bendel	Lagos	Rivers	Anambra	Benue	River	Gongola	Imo
ADP	Gusau	Funtua	Zone 2	Zone 3	Zone 4	Gombe	Azare	So.Borno	Bida	Lafia	Ilorin	Oyo-N.		Ekiti Akoko					Ayangba			
Area (3)		?																				
Prod (3)																						
Crop																						
Sorghum																						
Area	239.90	214.70		0.29	76.20	348.50	362.80		89.90		41.60											
Prod	200.00	149.60		200.00	37.10	260.00	300.00		100.00		26.00											
Millet																						
Area	226.20	112.00		276.40	83.30																	
Prod	210.00	40.70		200.00	71.40																	
E millet																						
Area						255.60	311.40												38.40			
Prod						210.00	310.00												33.70			
L millet																						
Area						14.90	29.20		13.60													
Prod						12.60	20.60		8.50													
Cowpeas																						
Area	219.80	27.00		242.60	65.60	252.30	236.30				13.40								21.30			
Prod	46.70	2.90		50.00	7.50	53.50	80.00				1.40								4.60			
G/nuts																						
Area	60.90	59.10		109.10	3.50	11.60	33.40		0.50		*											
Prod	48.00	19.90		53.60	0.00	6.80	21.40		7.50		1.30											
Cotton																						
Area	52.00	47.70				66.40																
Prod	20.20	16.90				23.90																
Maize																						
Area	14.30	64.30		3.80	1.90	89.70	7.00		17.60		48.70								183.60			
Prod	11.30	44.40		0.60	0.70	76.20	1.50		17.10		23.80								150.00			
Rice																						
Area									10.40													
Prod									21.00													
Melons																						
Area									40.40		4.90								17.10			
Prod									6.40		na								na			
Yam																						
Area									17.60		60.00								29.90			
Prod									140.00		660.00								270.00			
Cassava																						
Area									9.10		24.70								26.70			
Prod									63.60		130.00								58.90			

(2) 1979/80
[illegible]

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TABLE 2

AREA HARVEST ('000 HA) AND PRODUCTION ('000 TONNES) OF MAJOR CROPS BY STATE 1983/84

STATE		MILLET		G.CORN		G. NUT		BEANS		YAM		COTTON		MAIZE		CASSAVA		RICE		MELON		COCOYAM	
		AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD	AREA	PROD
ANAMBRA		-	-	0.065	.003	3	4	0.20	0.023	52	418	-	-	34	31	14	88	0.37	2	3	1	12	61
BAUCHI		386	289	242	158	16	10	21	7	-	-	9	9	43	31	1	4	4	2	-	-	-	-
BENDEL		-	-	0.05	0.01	1	1	0.18	0.04	63	552	-	-	58	33	19	216	0.47	0.45	33	19	0,11	0.08
BENUE		24	23	44	42	.8	29	2	1	74	689	-	-	60	65	14	160	6	13	9	7	1	11
BORNO		317	163	277	268	16	16	58	29	-	-	-	-	222	138	-	-	-	-	-	-	-	-
C. RIVER		-	-	-	-	-	-	-	-	27	179	-	-	10	5	7	59	0.12	0 08	1	2	4	2
GONGOLA		47	37	242	341	38	33	8	2	20	153	0.06	0.05	40	59	2	22	1	0.28	-	-	-	-
IMO		-	-	-	-	0.23	0.15	-	-	50	620	-	-	50	39	19	196	5	29	9	27	11	101
KADUNA		512	474	741	577	178	101	323	111	32	283	16	22	206	189	-	-	-	-	2	3	5	21
KANO		538	396	434	273	143	98	301	72	-	-	-	-	26	23	2	5	0.39	0.12	-	-	-	-
KWARA		15	13	37	47	2	2	4	1	37	351	-	-	33	42	2	2	22	29	4	4	1	3
LAGOS		-	-	-	-	-	-	-	-	0.10	1	-	-	0.33	0.11	0.20	1	-	-	0.05	0.004	-	-
NIGER		22	18	107	134	11	9	0.04	0.36	33	386	-	-	16	18	0.13	1	4	6	35	46	-	-
OGUN		-	-	-	-	1	1	0.18	0.12	1	8	-	-	14	16	1	13	1	2	2	2	-	-
ONDO		-	-	-	-	-	-	-	-	22	206	-	-	23	30	3	30	4	9	4	15	1	2
OYO		-	-	-	-	4	2	-	-	27	286	-	-	43	70	15	251	-	-	10	17	0.14	0.33
PLATEAU		35	28	142	139	5	3	5	2	74	747	-	-	93	103	0.20	1	1	1	1	1	0.23	0.33
RIVERS		-	-	-	-	-	-	-	-	12	108	-	-	11	59	8	125	-	-	-	-	1	5
SOKOTO		2100	1898	2013	2253	214	282	460	249	-	-	68	77	73	75	-	-	4	5	-	-	-	-
NIGERIA	1983/84	3986	3339	4279	4211	650	591	1183	475	524	4987	93	198	1058	1027	108	1174	53	99	113	144	36	205
	1982/83	3441	2772	4048	4081	497	396	1520	741	536	5909	85	120	556	626	80	909	95	203	54	51	49	224
	1981/82	3120	2752	3179	3535	650	419	1173	615	489	5260	46	39	438	639	71	[illegible]	92	180	92	75	79	310

- SOURCE : (FEDERAL OFFICE OF STATUTICS)

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NIGERIA : OTA

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TABLE [illegible]: NUMBER OF FARMING HOUSEHOLDS BY NUMBER AND AREA OF FARMS BY STATE - 1982/83/84

States	No.of Farming Households		Total No. of Farms		Total Area of Farm (In Hectares)		Average No. of Farms Per Farming H/Holds		Average Area (In Hectared Per Farming H/Holds		Average Area Per Farm in Hectares	
	1982/83	1983/84	1982/83	1983/84	1982/83	1983/84	1982/83	1983/84	1982/83	1983/84	1982/83	1983/84
Anambra	555	560	1,104	1,106	89	92	1.98	1.97	0.16	0.16	0.08	0.08
Bauchi	346	336	664	527	837	637	1.91	1.56	2.41	1.89	1.26	1.11
Bendel	178	127	287	272	88	118	1.61	2.14	0.49	0.92	0.30	0.42
Benue	273	265	470	450	213	212	1.72	1.69	0.78	0.81	0.45	0.47
Borno	387	331	540	664	759	806	1.30	2.00	1.96	2.43	1.40	1.71
C. River	251	248	374	404	61	49	1.49	1.62	0.24	0.19	0.15	0.12
Gongola	210	223	150	367	268	295	1.00	1.64	1.27	1.32	0.63	0.61
Imo	416	448	823	1,150	65	102	1.94	2.56	0.15	0.22	0.12	0.09
Kaduna	576	657	899	1,581	980	1,131	1.56	2.40	1.70	1.72	0.84	0.72
Kano	944	1,048	1,711	1,912	898	899	1.81	1.82	0.95	0.85	0.54	0.47
Kwara	108	96	113	164	91	117	1.04	1.70	0.84	1.21	0.80	0.72
Lagos	2	4	3	5	1	2	1.50	1.25	0.50	0.50	0.37	0.48
Niger	117	117	165	180	121	164	1.41	1.53	1.03	1.40	0.73	0.91
Ogun	50	44	55	51	25	18	1.10	1.15	0.50	0.40	0.31	0.36
Ondo	146	131	231	150	90	83	1.58	1.14	0.61	0.63	0.57	0.49
Oyo	145	136	224	170	100	115	1,54	1.25	0.68	0.84	0.44	0.68
Plateau	199	173	305	296	249	257	1.53	1.71	1.25	1.48	0.81	0.87
Rivers	70	113	120	197	22	36	1.71	1.74	0.31	0.31	0.18	0.18
Sokoto	672	780	1,214	1,110	1,551	1,249	1.82	1.58	2.30	1.60	0.97	1.12
Nigeria	5,635	5,837	9,452	10,761	6,508	6,382	1.67	1.84	1.15	1.09	0.65	0.66

NOTE: THE TOTAL NUMBER OF HOUSEHOLDS, FARMS AND TOTAL AREA OF FARMS ARE '000.

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Table 4—Nigeria: Composition of international trade, 1960-84

Trade/commodity	1960	1970	1975	1976	1977	1978
			Million dollars			
Imports:						
Grains	10	24	101	165	306	541
Animal products (food)	10	24	101	115	176	229
Nonfood agriculture	3.3	2.7	15	5.1	5.2	7.6
Other agriculture	32	41	292	269	410	450
Total agriculture	56	91	508	555	896	1,227
Total imports	605	1,042	6,234	7,727	10,030	11,995
Exports:						
Cocoa	98	186	224	301	470	592
Total agriculture	391	450	446	532	741	819
Petroleum	12	781	7,513	8,935	9,853	9,020
Total exports	464	1,221	8,026	9,486	10,638	9,887

Trade/commodity	1979	1980	1981	1982	1983	1984 1/
			Million dollars			
Imports:						
Grains	305	462	748	561	467	442
Animal products (food)	199	321	350	331	165	137
Nonfood agriculture	7.2	6.9	13	30	21	18
Other agriculture	429	852	1010	807	552	403
Total agriculture	940	1,642	2,122	1,728	1,205	1,000
Total imports	9,789	15,854	19,370	20,256	14,066	NA
Exports:						
Cocoa	456	403	247	198	271	431
Total agriculture	701	467	333	404	460	NA
Petroleum	16,131	23,877	18,103	14,812	11,359	11,269
Total exports	17,020	24,659	18,676	15,241	11,844	11,701

NA = Not available.
Note: Totals may not add due to rounding.
1/ 1984 imports from USDA/ERS estimates.

Sources: (61, 107)

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Table 5 Women's main occupation outside the home , by Reion

	West	North	East
	n=142	n=120	n=138
Farming	10	5.9	88
Trading	88	90	5.6
Processing	1.9	4.0	5.7

Table 6. Most Important crops grown

	West	North	East
	n=35	n=32	n=73
Maize	81.23	100	97.8
Cassava	12.5		2.2
Cocoa	6.25		

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Table 7. Food crops Sold

	West n=77	North n=68	East n=15
Maize	22.9		50
Rice	21		20
Yam	14		10
Cassava	13		20
Sorghum		37	
Millet		24	

Table 8 Agric. Income and Exp.

	West n=142	North n=120	East n=138
Avg. Income			
per month	90 N	70N	80N
per woman			
Per man	150N	100N	110N
Food exp/month	22N	17N	20N

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NIGERIA - OTA

TABLE ~~[illegible]~~ 9: % DISTRIBUTION OF CULTIVATED LAND BY TENURE PATTERN, 1983/84

States	Total Area	Owner-Like Possession	Rented	Others
Anambra	100	90.02	5.50	4.50
Bauchi	100	90.56	9.21	0.23
Bendel	100	97.76	2.17	0.01
Benue	100	91.90	2.66	5.44
Borno	100	97.14	1.37	1.49
C. River	100	66.14	2.85	31.00
Gongola	100	97.28	1.02	1.69
Imo	100	97.24	1.71	1.06
Kaduna	100	91.65	2.74	5.61
Kano	100	95.38	4.56	0.06
Kwara	100	89.15	7.85	3,01
Lagos	100	54.67	44.44	0.89
Niger	100	96.65	2.73	0.61
Ogun	100	70.70	21.19	8.11
Ondo	100	96.36	3.58	0.06
Oyo	100	86.81	11.45	1.74
Plateau	100	96.42	2.80	0.78
Rivers	100	93.20	6.80	-
Sokoto	100	93.24	6.54	0.22
Nigeria	100	94.42	3.62	1.96

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TABLE 10: AVERAGE PERSONS PER HH BY FARMING PATTERN AND STATE: NIGERIA 1983/84

STATE	AVERAGE PERSONS				
	Farming Only	Livestock Only	Livestock And Farming	Non Farming Non L/stock	All Household
Anambra	4.64	4.54	6.29	2.87	5.29
Bauchi	4.45	3.97	6.40	3.26	5.88
Bendel	5.54	6.25	8.16	4.65	5.82
Benue	5.71	7.00	7.90	3.85	6.45
Borno	3.92	5.70	7.11	3.50	5.62
Cross River	5.80	5.13	7.09	4.10	5.07
Gongola	5.00	5.39	6.78	4.06	5.66
Imo	3.68	5.78	4.62	3.08	3.83
Kaduna	5.50	5.53	6.50	3.96	6.32
Kano	4.37	6.42	6.52	4.30	6.11
Kwara	4.83	5.35	6.27	4.09	5.01
Lagos	5.11	5.79	6.63	5.20	5.73
Ogun	4.06	3.77	4.79	3.15	3.70
Ondo	5.06	5.24	6.64	3.64	4.57
Oyo	4.13	4.81	5.79	3.16	4.13
Plateau	5.36	6.33	7.91	4.89	6.84
Rivers	6.32	6.59	8.37	4.11	5.49
Sokoto	3.81	3.50	5.49	1.96	5.05
NIGERIA	4.92	5.37	6.66	3.81	5.34

TABLE 13. NIGERIA: CHEMICAL FERTILIZER USE BY CROP WITHIN PROJECT & STATE

TABLE 13.

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State	Sokoto	Kaduna	Kano			Bauchi		Borno	Niger	Plateau	Kwara	Oyo	Ogun	Imo	Bendel	Lagos	CROSS Rivers	Anambra	Benue	Rivers	Gongola	IAG
ADP	Gusau	Funtua	Zone 2	Zone 3	Zone 4	Gombe	Azare	So.Borno	Bida	Lafia	Ilorin	Oyo-N.		Atoko					Ayangba			
	Percent of Project Area with Inorganic Fertilizer																					
CROP																						
sorghum	42.00		21.00	20.00	11.00	34.00	49.00		41.00		34.00											
millet	41.00		14.00	79.00	16.00																	
e millet						40.00	45.00												43.00			
l millet						15.00	25.00		23.00													
cowpeas	41.00		20.00	21.00	10.00	47.00	52.00				15.00								8.00			
g/nuts	46.00		32.00	21.00	41.00	30.00	45.00		60.00		32.00											
cotton	42.00					52.00																
maize	42.00		24.00	0.00	0.00	71.00	82.00		23.00		36.00								18.00			
rice									64.00													
mellons									58.00		29.00								2.00			
yam									20.00		17.00								23.00			
cassava									56.00		12.00								30.00			
peppers				17.00																		

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TABLE ~~9~~ 14.1

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER (KG/HA & % OF AREA)

CROP		1975/76	1976/77	1977/78	1978/79	1979/80	
		abw					
COTTON							
WITH:	YIELD		171	310	785	564	−3%
	% AREA		18	23	17	15	
WITHOUT:	YIELD		177	233	669	311	
	% AREA		82	77	83	85	
COWPEA							
WITH:	YIELD		65	72	63	150	−9%
	% AREA		23	47	54	14	
WITHOUT:	YIELD		35	128	81	95	
	% AREA		77	53	46	86	
GROUNDNUT							
WITH:	YIELD		315	338	425	474	+ 10%
	% AREA		29	15	58	39	
WITHOUT:	YIELD		234	277	358	250	
	% AREA		71	85	42	61	
MAIZE							
WITH:	YIELD		162	203	642	1084	+ 21%
	% AREA		29	22	48	50	
WITHOUT:	YIELD		206	250	391	292	
	% AREA		71	78	52	50	
MILLET							
WITH:	YIELD		355	314	367	431	+ 15%
	% AREA		23	26	42	39	
WITHOUT:	YIELD		276	367	437	440	
	% AREA		77	74	58	61	
SORGHUM							
WITH:	YIELD		557	702	543	804	+ 26%
	% AREA		24	22	44	50	
WITHOUT:	YIELD		505	572	587	625	
	% AREA		76	78	56	50	

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1/ 1976/77 DATA CONTAIN SOME SPURIOUS ZERO VALUES AND

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GOMBE
TABLE 15.2

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1977/78	1978/79	1979/80	
		abW			
COTTON					
WITH:	YIELD	305	465	416	+ 14%
	% AREA	22	50	36	
WITHOUT:	YIELD	462	574	434	
	% AREA	78	50	64	
COWPEA					
WITH:	YIELD	444	212	152	− 5%
	% AREA	19	45	14	
WITHOUT:	YIELD	77	152	142	
	% AREA	81	55	86	
GROUNDNUT					
WITH:	YIELD	631	194	128	− 4%
	% AREA	11	46	7	
WITHOUT:	YIELD	402	555	542	
	% AREA	89	54	93	
MAIZE					
	YIELD	740	560	896	+ 3%
	% AREA	25	38	28	
WITHOUT:	YIELD	326	609	599	
	% AREA	75	62	72	
MILLET					
WITH:	YIELD	415	476	477	+ 4%
	% AREA	11	31	15	
WITHOUT:	YIELD	534	693	549	
	% AREA	89	69	85	
SORGHUM					
WITH:	YIELD	618	713	766	+ 5%
	% AREA	10	23	15	
WITHOUT:	YIELD	688	700	671	
	% AREA	90	77	85	

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GUSAU
TABLE 14.3

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1975/76	1976/77	1977/78	1978/79	1979/80	
				abw			
COTTON							
WITH:	YIELD		267	546	1048	797	−1 %
	% AREA		19	38	21	18	
WITHOUT:	YIELD		358	328	622	490	
	% AREA		81	62	79	82	
COWPEA							
WITH:	YIELD		76	148	155	257	+ 8%
	% AREA		20	41	44	28	
WITHOUT:	YIELD		86	144	246	226	
	% AREA		80	59	56	72	
GROUNDNUT							
WITH:	YIELD		528	662	573	880	+ 16%
	% AREA		20	49	44	36	
WITHOUT:	YIELD		308	588	589	686	
	% AREA		80	51	56	64	
MILLET							
WITH:	YIELD		784	1037	1072	1192	+ 4%
	% AREA		17	42	31	21	
WITHOUT:	YIELD		707	965	956	1130	
	% AREA		83	58	69	79	
SORGHUM							
WITH:	YIELD		543	679	593	929	+ 8%
	% AREA		18	37	37	26	
WITHOUT:	YIELD		614	873	759	809	
	% AREA		82	63	63	74	

TABLE 14.4 Lafia

TABLE

13/4/83

Draft

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1978/79	1979/80	1980/81	1981/82	1982/83	
				cR			
SORGHUM							
WITH:	YIELD			NA	780		+7%
	% AREA			11	18		
WITHOUT:	YIELD			NA	714		
	% AREA			89	82		
MAIZE							
WITH:	YIELD			NA	802		+14%
	% AREA			18	32		
WITHOUT:	YIELD			NA	621		
	% AREA			82	68		
YAM							
WITH:	YIELD			NA	11444		-2%
	% AREA			25	23		
WITHOUT:	YIELD			NA	9420		
	% AREA			75	77		
MILLET							
WITH:	YIELD			NA	703		+5%
	% AREA			10	15		
WITHOUT:	YIELD			NA	793		
	% AREA			90	85		
CASSAVA							
WITH:	YIELD			NA	4997		+21%
	% AREA			10	31		
WITHOUT:	YIELD			NA	3853		
	% AREA			90	69		
GNUTS							
WITH:	YIELD			NA	371		
	% AREA			NA	23		
WITHOUT:	YIELD			NA	630		
	% AREA			NA	77		

SOKOTO,...
Gusau
10/

Draft

TABLE 14.5

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
			b				
SORGHUM							
WITH:	YIELD	1082	565	852			
	% AREA	48	53	42	-6%		
WITHOUT:	YIELD	674	601	792			
	% AREA	52	47	58			
MILLET							
WITH:	YIELD	1081	822	1050			
	% AREA	47	53	41	-6%		
WITHOUT:	YIELD	770	774	892			
	% AREA	53	47	59			
COWPEAS							
WITH:	YIELD	425	136	259			
	% AREA	49	55	41	-8%		
WITHOUT:	YIELD	206	102	187			
	% AREA	51	45	59			
G/NUTS							
WITH:	YIELD	1299	661	854			
	% AREA	44	47	46	+2%		
WITHOUT:	YIELD	699	648	738			
	% AREA	56	53	54			
COTTON							
WITH:	YIELD	460	427	440			
	% AREA	44	58	42	-2%		
WITHOUT:	YIELD	391	386	361			
	% AREA	57	42	58			
MAIZE							
WITH:	YIELD	307	1010	1039			
	% AREA	45	44	42	-3%		
WITHOUT:	YIELD	388	499	608			
	% AREA	55	56	58			

KANO ZONE 3 ([illegible])
TABLE # 14.6

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER (KG/HA & % OF AREA)

Draft

CROP		1982/83	1983/84	1984/85	1985/86	1986/87
		bw				
COWPEA						
WITH:	YIELD	221				
	% AREA	21				
WITHOUT:	YIELD	202				
	% AREA	79				
GROUNDNUT						
WITH:	YIELD	543				
	% AREA	21				
WITHOUT:	YIELD	480				
	% AREA	79				
MAIZE						
WITH:	YIELD	-				
	% AREA	0				
WITHOUT:	YIELD	120				
	% AREA	100				
MILLET						
WITH:	YIELD	692				
	% AREA	79				
WITHOUT:	YIELD	746				
	% AREA	21				
PEPPERS						
WITH:	YIELD	266				
	% AREA	17				
WITHOUT:	YIELD	58				
	% AREA	83				
SORGHUM						
WITH:	YIELD	826				
	% AREA	20				
WITHOUT:	YIELD	674				
	% AREA	80				

NOTES: 1/ YIELDS EXCLUDE ENUMERATION FAILURES AND PLOTS WITH VERY HIGH YIELDS LACKING TECHNICAL CREDIBILITY.

KANO ZONE 4 (GUMEL)
TABLE ~~8~~ 14.7

Draft

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER (KG/HA & % OF AREA)

CROP	1982/83	1983/84	1984/85	1985/86	1986/87
	bW				
COWPEA					
WITH: YIELD	118				
% AREA	10				
WITHOUT: YIELD	114				
% AREA	90				
GROUNDNUT					
WITH: YIELD	290				
% AREA	41				
WITHOUT: YIELD	185				
% AREA	59				
MAIZE					
WITH: YIELD	-				
% AREA	0				
WITHOUT: YIELD	373				
% AREA	100				
MILLET					
WITH: YIELD	958				
% AREA	10				
WITHOUT: YIELD	845				
% AREA	90				
SORGHUM					
WITH: YIELD	498				
% AREA	11				
WITHOUT: YIELD	485				
% AREA	89				

NOTES: 1/ YIELDS EXCLUDE ENUMERATION FAILURES AND PLOTS WITH VERY HIGH YIELDS LACKING TECHNICAL CREDIBILITY.

Draft

ILORIN
TABLE ~~9.1~~ 14.8

7/8/83

TABLE 9

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1980/81	1981/82	1982/83	1983/84	1984/85	
			b				
SORGHUM							
WITH:	YIELD	790	659	707			
	% AREA	26	40	34			+8%
WITHOUT:	YIELD	771	663	590			
	% AREA	74	60	66			
COWPEAS							
WITH:	YIELD	71	117	89			
	% AREA	20	31	15			-5%
WITHOUT:	YIELD	301	78	94			
	% AREA	80	69	85			
GROUNDNUTS							
WITH:	YIELD	121	2098	913			
	% AREA	2	20	32			+30%
WITHOUT:	YIELD	83	702	484			
	% AREA	98	80	68			
MAIZE							
WITH:	YIELD	1212	842	539			
	% AREA	33	48	38			+5%
WITHOUT:	YIELD	787	546	459			
	% AREA	67	52	42			
MELONS							
WITH:	YIELD	NA	NA	NA			
	% AREA	26	29	29			+3%
WITHOUT:	YIELD	NA	NA	NA			
	% AREA	73	71	71			

7,1

TABLE ~~9~~ 14.9 Draft

ILORIN
TABLE

7/8/83

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1980/ 81	1981/ 82	1982/ 83	1983/ 84	1984/ 85
			b			
YAM						
WITH:	YIELD	9158	3625	11013		
	% AREA	11	26	17	+6%	
WITHOUT:	YIELD	6656	5855	11341		
	% AREA	89	74	83		
CASSAVA						
WITH:	YIELD	184	117	11341		
	% AREA	24	27	12	-12%	
WITHOUT:	YIELD	485	1107	867		
	% AREA	76	73	88		

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BAUCHI, GOMBE
TABLE ~~[illegible]~~ 14.

19/8/83

TABLE ~~[illegible]~~ 14.10

LDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

ROP	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
		b				
GUM						
: YIELD	607	796	696	+ 20%		
% AREA	14	28	34			
HOUT: YIELD	710	793	720			
% AREA	86	72	66			
ILLET early						
TH: YIELD	817	861	698	+ 23 %		
% AREA	17	35	40			
THOUT: YIELD	619	762	897			
% AREA	83	65	60			
MILLET Late						
ITH: YIELD	405	795	1003	+ 10%		
% AREA	14	20	24			
ITHOUT: YIELD	630	614	793			
% AREA	86	80	76			
OWPEAS						
ITH: YIELD	193	248	234	+ 12%		
% AREA	35	45	47			
WITHOUT: YIELD	208	213	189			
% AREA	65	55	53			

Draft

BAUCHI,GOMBE 14.11
TABLE ~~9.2~~
19/8/83

TABLE ~~9.2~~ 14.11

LDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

ROP		1980/ 81	1981/ 82	1982/ 83	1983/ 84	1984/ 85	1985/ 86	1
NDNUTS								
H:	YIELD	348	561	666	−3%			
	% AREA	33	18	30				
HOUT:	YIELD	375	671	552				
	% AREA	67	82	70				
TON								
TH:	YIELD	479	770	380	+ 26%			
	% AREA	26	19	52				
THOUT:	YIELD	619	724	415				
	% AREA	74	81	48				
IZE								
TH:	YIELD	1260	1160	921	+ 8%			
	% AREA	63	61	71				
THOUT:	YIELD	1009	791	885				
	% AREA	37	39	29				

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Draft

BIDA
TABLE 14.12

10/8/83

14.12
TABLE

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1980/81	1981/82	1982/83	1983/84	1984/85	
		bR		b			
SORGHUM							
WITH:	YIELD	1128	1368	1131			+ 23%
	% AREA	28	43	41			
WITHOUT:	YIELD	1668	1018	1171			
	% AREA	72	57	59			
L MILLET							
WITH:	YIELD	544	893	486			− 5%
	% AREA	28	30	23			
WITHOUT:	YIELD	869	612	710			
	% AREA	72	70	77			
RICE							
WITH:	YIELD	2279	2717	2258			+ 40%
	% AREA	44	74	84			
WITHOUT:	YIELD	2831	2722	1068			
	% AREA	56	26	16			
MAIZE							
WITH:	YIELD	2924	1463	1157			no Δ
	% AREA	23	22	23			
WITHOUT:	YIELD	1201	602	916			
	% AREA	77	78	77			
MELONS							
WITH:	YIELD	1034	131	120			+ 25%
	% AREA	33	38	58			
WITHOUT:	YIELD	1290	143	218			
	% AREA	67	62	42			
GROUNDNUTS							
WITH:	YIELD	838	1447	723			+ 28%
	% AREA	40	66	60			
WITHOUT:	YIELD 3//.	1099	946	1139			
		60	34	40			

Draft

BIDA 14.13
TABLE

10/8/83

TABLE 14.13

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1980/81	1981/82	1982/83	1983/84	1984/85	
		bR		b			
YAM							
WITH:	YIELD	3526	3687	7038			+ 10%
	% AREA	10	18	20			
WITHOUT:	YIELD	5924	6426	8406			
	% AREA	90	82	80			
CASSAVA							
WITH:	YIELD	3561	632	7347			+ 48%
	% AREA	8	40	56			
WITHOUT:	YIELD	1285	1527	6098			
	% AREA	92	60	44			

Draft

AYANGBA
TABLE ~~9~~ 14.14

12/8/83

TABLE ~~9~~ 14.14

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1978/79	1979/80	1980/81	1981/82	1982/83	
				bR			
MAIZE							
WITH:	YIELD			1206	742	1081	+ 7%
	% AREA			11	9	18	
WITHOUT:	YIELD			840	695	738	
	% AREA			89	91	72	
EARLY MILLET							
WITH:	YIELD			650	799	942	+ 6%
	% AREA			37	7	43	
WITHOUT:	YIELD			1182	723	843	
	% AREA			63	93	57	
COWPEA							
WITH:	YIELD			183	168	234	−11%
	% AREA			19	19	8	
WITHOUT:	YIELD			242	142	235	
	% AREA			81	81	92	
MELON							
WITH:	YIELD			6	2	1	− 12%
	% AREA			14	4	2	
WITHOUT:	YIELD			6	3	2	
	% AREA			86	96	98	
YAM							
WITH:	YIELD			5427	9096	10392	+ 20%
	% AREA			3	7	23	
WITHOUT:	YIELD			9322	7236	8245	
	% AREA			97	93	77	
CASSAVA							
WITH:	YIELD			10854	N/A	3506	+ 20%
	% AREA			10	5	30	
WITHOUT:	YIELD			3629	3223	3623	
	% AREA			90	95	70	

3/7

TABLE # 14.15 **Draft** TABLE # 14.15

6/8/83

YIELDS AND AREAS OF MAJOR CROPS WITH AND WITHOUT INORGANIC FERTILISER

(KG./HA. AND % OF AREA)

CROP		1982/83	1983/84	1984/85	1985/86	1986/87
SORGHUM						
WITH:	YIELD	950				
	% AREA	49				
WITHOUT:	YIELD	969				
	% AREA	51				
E MILLET						
WITH:	YIELD	1017				
	% AREA	45				
WITHOUT:	YIELD	969				
	% AREA	55				
L MILLET						
WITH:	YIELD	857				
	% AREA	25				
WITHOUT:	YIELD	1025				
	% AREA	75				
COWPEAS						
WITH:	YIELD	384				
	% AREA	52				
WITHOUT:	YIELD	295				
	% AREA	48				
GROUNDNUTS						
WITH:	YIELD	460				
	% AREA	45				
WITHOUT:	YIELD	808				
	% AREA	55				
MAIZE						
WITH:	YIELD	121				
	% AREA	82				
WITHOUT:	YIELD	698				
	% AREA	18				

TABLE 11.1 Draft Latia

TABLE 2

25/3/8

Total H
1865

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING

BY CROP (HA. KG. & %)

	1978/ 79	1979/ 80	1980/ 81	1981/ 82	1982/ 83
			— cR	—	
SORGHUM					
MEAN HH AREA			1.14	1.27	
MEAN HH PRODN.			965	921	
% HHS GROWING			NA	95	
MAIZE					
MEAN HH AREA			0.71	0.67	
MEAN HH PRODN.			731	455	
% HHS GROWING			NA	72	
YAM					
MEAN HH AREA				0.66	
MEAN HH PRODN.				6597	
% HHS GROWING				92	
MILLET					
MEAN HH AREA			0.59	0.62	
MEAN HH PRODN.			494	482	
% HHS GROWING			NA	53	
CASSAVA					
MEAN HH AREA				0.38	
MEAN HH PRODN.				1498	
% HHS.GROWING				47	
G/NUT					
MEAN HH AREA				0.19	
MEAN HH PRODN.				107	
% HHS GROWING				27	

Not calculated for lack of data

Draft

SOKOTO,GUSAU
TABLE 7

10/8/83

TABLE 4 11.2

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING

BY CROP (HA. KG. & %)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Total HHS	69000		179000			
	b					
SORGHUM						
MEAN HH AREA	1.71	1.69	1.34			
MEAN HH PRODN.	1495	923	1099			
% HHS GROWING	95	95	97			
MILLET						
MEAN HH AREA	1.49	1.27	1.23			
MEAN HH PRODN.	1370	1020	1176			
% HHS GROWING	95	95	98			
COWPEAS						
MEAN HH AREA	1.54	1.42	1.20			
MEAN HH PRODN.	485	170	261			
% HHS GROWING	82	88	88			
G/NUTS						
MEAN HH AREA	0.68	0.64	0.34			
MEAN HH PRODN.	705	395	268			
% HHS GROWING	74	74	57			
COTTON						
MEAN HH AREA	0.6	0.22	0.29			
MEAN HH PRODN.	275	66	113			
% HHS.GROWING	58	31	34			
MAIZE						
MEAN HH AREA	0.07	0.04	0.08			
MEAN HH PRODN.	37	19	63			
% HHS GROWING	11	11	17			

Draft

KANO ZONE 3 (B/KUDU)
TABLE 11.3

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING
BY CROP (HA. KG. & %)

Total HHS 155C55

	1982/ 83	1983/ 84	1984/ 85	1985// 86	1986/ 87
	DW				
COWPEA					
MEAN HH AREA	1.29				
MEAN HH PRODN.	265				
% HHS GROWING	77				
GROUNDNUT					
MEAN HH AREA	0.58				
MEAN HH PRODN.	285				
% HHS GROWING	49				
MAIZE					
MEAN HH AREA	0.02				
MEAN HH PRODN.	3				
% HHS GROWING	3				
MILLET					
MEAN HH AREA	1.47				
MEAN HH PRODN.	1080				
% HHS.GROWING	80				
SORGHUM					
MEAN HH AREA	1.54				
MEAN HH PRODN.	1087				
% HHS GROWING	92				

NOTES: 1/ PRODUCTION ESTIMATES BASED ON CLEANED YIELD DATA,
SEE TABLES 6.1-6.2.

Draft

KANO ZONE 4 (GUMEL)
TABLE 11.4

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING

BY CROP (HA. KG. & %)

Total HHS 23601

	1982/83 1/	1983/84	1984/85	1985//86	1986/87
COWPEA					
MEAN HH AREA	2.78				
MEAN HH PRODN.	317				
% HHS GROWING	78				
GROUNDNUT					
MEAN HH AREA	0.15				
MEAN HH PRODN.	34				
% HHS GROWING	12				
MAIZE					
MEAN HH AREA	0.08				
MEAN HH PRODN.	30				
% HHS GROWING	3				
MILLET					
MEAN HH AREA	3.53				
MEAN HH PRODN.	3025				
% HHS.GROWING	95				
SORGHUM					
MEAN HH AREA	3.23				
MEAN HH PRODN.	1570				
% HHS GROWING	83				

NOTES: 1/ PRODUCTION ESTIMATES BASED ON CLEANED YIELD DATA, SEE TABLES 6.1-6.3.

Draft

ILORIN
TABLE 7

7/8/83

TABLE 11.5

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING BY CROP (HA. KG. & %)

Total HHS	66630 1980/81	1981/82	70578 1982/83	1983/84	1984/85
SORGHUM					
MEAN HH AREA	.70	0.55	0.59		
MEAN HH PRODN.	547	361	369		
% HHS GROWING	92	87	78		
COWPEAS					
MEAN HH AREA	.15	0.10	0.19		
MEAN HH PRODN.	48	9	~~20~~		
% HHS GROWING	20	19	29		
GROUNDNUTS					
MEAN HH AREA	.06	0.02	0.02		
MEAN HH PRODN.	5	24	19		
% HHS GROWING	13	10	13		
MAIZE					
MEAN HH AREA	.93	0.79	0.69		
MEAN HH PRODN.	1007	541	338		
% HHS GROWING	91	96	85		
MELONS					
MEAN HH AREA	0.23	0.09	0.07		
MEAN HH PRODN.	NA	NA	NA		
% HHS GROWING	44	29	16		
YAM					
MEAN HH AREA	0.71	0.83	0.85		
MEAN HH PRODN.	4908	4390	9386		
% HHS GROWING	96	98	96		
CASSAVA					
MEAN HH AREA	0.35	0.45	0.35		
MEAN HH PRODN.	165	381	1905		
% HHS GROWING	60	70	58		

TABLE 12.1 **Draft** BAUCHI, GOMBE

TABLE 12.

19/8/83

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING BY CROP (HA. KG. & %)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	198
Total HHS	76000		166 000				
	b						
SORGHUM							
MEAN HH AREA	1.69	1.80	2.22				
MEAN HH PRODN.	1176	1424	1584				
% HHS GROWING	88	93	96				
MILLET							
MEAN HH AREA	0.57	0.90	1.54				
MEAN HH PRODN.	367	717	1257				
% HHS GROWING	56	61	75				
MILLET							
MEAN HH AREA	0.23	0.25	0.09				
MEAN HH PRODN.	138	161	76				
% HHS GROWING	18	15	7				
COWPEAS							
MEAN HH AREA	0.60	0.80	1.52				
MEAN HH PRODN.	122	193	322				
% HHS GROWING	39	49	74				
GROUNDNUTS							
MEAN HH AREA	0.11	0.20	0.07				
MEAN HH PRODN.	55	99	41				
% HHS.GROWING	22	25	14				
COTTON							
MEAN HH AREA	0.56	0.20	0.40				
MEAN HH PRODN.	326	149	144				
% HHS GROWING	40	18	22				
MAIZE							
MEAN HH AREA	0.60	0.30	0.51				
MEAN HH PRODN.	703	311	459				
% HHS GROWING	48	37	37				

TABLE # 12-2 Draft

BIDA
TABLE # 12.2

10/8/83

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING

BY CROP (HA. KG. & %)

	1980/81	1981/82	1982/83	1983/84	1984/85.
Total HHS	61000		65140		
	BR		b		
SORGHUM					
MEAN HH AREA	1.05	0.65	1.38		
MEAN HH PRODN.	1598	759	1593		
% HHS GROWING	88	87	93		
L MILLET					
MEAN HH AREA	.32	0.20	0.20		
MEAN HH PRODN.	253	139	131		
% HHS GROWING	45	41	33		
RICE					
MEAN HH AREA	0.31	0.16	0.16		
MEAN HH PRODN.	801	435	332		
% HHS GROWING	51	51	33		
MAIZE					
MEAN HH AREA	.11	0.13	0.27		
MEAN HH PRODN.	139	101	262		
% HHS.GROWING	27	39	49		
MELONS					
MEAN HH AREA	0.57	0.35	0.62		
MEAN HH PRODN.	673	49	99		
% HHS GROWING	71	59	68		
GROUNDNUTS					
MEAN HH AREA	0.27	0.19	0.13		
MEAN HH PRODN.	267	243	115		
% HHS GROWING	38	46	35		
YAM					
MEAN HH AREA	0.26	0.11	0.27		
MEAN HH PRODN.	1509	640	2196		
% HHS GROWING	51	40	68		
CASSAVA					
MEAN HH AREA	0.17	0.05	0.14		
MEAN HH PRODN.	256	58	977		
% HHS GROWING	19	17	19		

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TABLE ~~7~~ 12.3
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TABLE ~~3~~ 12.3

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING BY CROP (HA. KG. & %)

		1978/79	1979/80	1980/81	1981/82	1982/83	
				bR			
x Total HHS ?				101600	104140	106744	('000 HA '000 MT
MAIZE							
MEAN HH AREA				1.52	1.01	1.72	
MEAN HH PRODN.				1247	699	1395	
% HHS GROWING				98	97	96	
	A			154432		183600	+ 29.168
EARLY MILLET	P			1.26,700000		149010,000	+22,310000
MEAN HH AREA				0.07	0.14	0.36	
MEAN HH PRODN.				72	103	316	
% HHS GROWING				17	15	42	
	A			7112		~~106744~~ 35428	+ 31716
COWPEA	P			763200		4487248	+ 3.724048
MEAN HH AREA				0.12	0.06	0.20	
MEAN HH PRODN.				21	9	43	
% HHS GROWING				7	14	23	
	A			12192		21349	+ 9.157
MELON	P			2133600		2455112	+.321512
MEAN HH AREA				0.40	0.22	0.16	
MEAN HH PRODN.				2	1	*	
% HHS GROWING				48	39	19	
	A			40640		17079	
YAM	P			4876800		2028136	
MEAN HH AREA				0.34	0.34	0.28	
MEAN HH PRODN.				3085	2457	2485	
% HHS.GROWING				87	83	89	
	A			34544		29888	
CASSAVA	P			5839200		9500216	
MEAN HH AREA				0.10	0.30	0.25	
MEAN HH PRODN.				319	340	552	
% HHS GROWING				33	57	47	
	A			10160		26686	
	P			3352800		5016968	

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TABLE 7
6/8/83

TABLE 12.4

HOUSEHOLD AREA, PRODUCTION AND PROPORTIONS GROWING BY CROP (HA. KG. & %)

Total HHS 139000

	1982/83 b	1983/84	1984/85	1985/86	1986/87
SORGHUM					
MEAN HH AREA	2.61				
MEAN HH PRODN.	2179				
% HHS GROWING	98				
E MILLET					
MEAN HH AREA	2.24				
MEAN HH PRODN.	2220				
% HHS GROWING	100				
L MILLET					
MEAN HH AREA	0.21				
MEAN HH PRODN.	206				
% HHS GROWING	36				
COWPEAS					
MEAN HH AREA	1.70				
MEAN HH PRODN.	581				
% HHS GROWING	78				
GROUNDNUTS					
MEAN HH AREA	0.24				
MEAN HH PRODN.	154				
% HHS.GROWING	21				
MAIZE					
MEAN HH AREA	0.05				
MEAN HH PRODN.	11				
% HHS GROWING	15				

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/5.1

TABLE [illegible]

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF MILLET BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/32	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	-	-	-	0.42	-	-	0.42	-	-
	P	-	-		0.25		-	0.25	-	-
	YPH	-	-	-	595	-	-	595	-	-
BAUCHI	AH	63	69	139	417	548	247	480	617	386
	P	58	51	126	216	309	163	274	360	289
	YPH	921	739	906	518	564	660	571	583	749
BENDEL	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
BENUE	AH	1	1	6	8	20	18	9	21	24
	P	1	1	6	10	16	17	11	17	23
	YPH	1,000	1,000	1,000	1,250	800	944	1,222	810	958
BORNO	AH	334	325	195	156	179	122	490	504	317
	P	233	154	71	53	102	92	286	256	163
	YPH	698	474	364	340	570	754	584	508	514
C/RIVER	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
GONGOLA	AH	1	3	4	3	32	43	4	35	47
	P	1	4	3	7	27	34	8	31	37
	YPH	1,000	1,333	750	2,333	844	791	2,000	886	787
IMO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KADUNA	AH	16	21	41	388	442	471	404	463	512
	P	20	25	40	418	412	434	438	437	474
	YPH	1,250	1,190	976	1,077	932	921	1,084	944	926
KANO	AH	8	5	9	447	542	529	455	547	538
	P	8	5	7	363	526	389	371	531	396
	YPH	1,000	1,000	778	812	970	735	815	971	736
KWARA	AH	-	-	-	2	3	5	2	3	5
	P	-	-	-	2	5	13	2	5	13
	YPH	-	-	-	1,000	1,667	2,600	1,000	1,667	2,600
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	0.22	0.02	2	9	9	20	9	9	22
	P	1	0.13	2	11	14	16	12	14	18
	YPH	4,545	2,600	1,000	1,222	1,556	800	1.333	1,556	818
OGUN	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
ONDO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
OYO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
PLATEAU	AH	15	9	9	68	30	26	83	39	35
	P	20	8	6	41	36	22	61	44	28
	YPH	1,333	889	667	603	1,200	846	735	1,128	800
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	22	41	94	1,162	1,162	2,006	1,184	1,203	2.100
	P	26	49	116	1,263	1,028	1,782	1,289	1,077	1,898
	YPH	1,182	1,195	1,234	1,087	885	888	1,089	895	904
TOTAL	AH	460	474	499	2,660	2,967	3,487	3,120	3,441	3,986
	P	368	297	377	2,384	2,475	2,962	2,752	2,772	3,339
	YPH	800	627	756	896	834	849	882	806	838

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TABLE ~~2.6~~ 15.2 AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF GUINEA-CORN BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	-	-	-	-	0.18	0.065	-	0.18	0.065
	P	-	-	-	-	0.09	0.003	-	0.09	0.003
	YPH	-	-	-	-	500	46	-	500	46
BAUCHI	AH	142	109	128	354	313	114	496	422	242
	P	254	83	88	376	220	70	630	303	158
	YPH	1,789	761	688	1,062	703	614	1,270	718	653
BENDEL	AH	-	-	-	-	-	0.05	-	-	0.05
	P	-	-	-	-	-	0.01	-	-	0.01
	YPH	-	-	-	-	-	200	-	-	200
BENUE	AH	20	9	10	34	51	34	54	60	44
	P	24	8	8	19	41	34	43	49	42
	YPH	1,200	889	800	559	804	1,000.	796	817	955
BORNO	AH	80	177	241	71	16	36	151	193	277
	P	102	88	244	20	46	24	122	134	268
	YPH	1,275	497	1,012	282	2,875	667	808	694	968
C/RIVER	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
GONGOLA	AH	88	219	156	27	77	86	115	296	242
	P	217	153	261	43	114	80	260	267	341
	YPH	2,466	699	1,673	1.593	1,481	930	2,261	902	1,409
IMO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KADUNA	AH	124	177	138	432	497	603	556	674	741
	P	118	235	127	320	513	450	438	748	577
	YPH	952	1,328	920	741	1,032	746	788	1.110	779
KANO	AH	48	44	28	620	634	406.	668	678	434
	P	42	41	17	490	604	256	532	645	273
	YPH	875	932	607	790	953	631	796	951	629
KWARA	AH	3	5	4	19	35	33	22	40	37
	P	5	10	6	103	50	41	108	60	47
	YPH	1,667	2.000	1,500	5,421	1,429	1,242	4,909	1,500	1,270
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	75	49	33	60	38	74	135	87	107
	P	102	63	.51	71	58	83	173	121	134
	YPH	1,360	1,286	1,545	1,183	1,526	1,122	1,281	1,391	1,252
OGUN	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
ONDO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
OYO	AH	0.18	0.18	-	0.33	1	-	1	1	-
	P	0.13	0.12	-	0.43	1	-	1	1	-
	YPH	722	667	-	1,303	1,000	-	1,000	1,000	-
PLATEAU	AH	63	105	59	93	75	83	156	180	142
	P	122	159.	48	217	41	90	339	200	138
	YPH	1,937	1,514	814	2,333	547	1,084	2,173	1,111	972
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	60	271	222	765	1,146	1,791	825	1,417	2,013
	P	71	834	227	819	719	2,026	890	1,553	2,253
	YPH	1,183	3,077	1,023	1,071	627	1,131	1,079	1,006	1,119
TOTAL	AH	703	1,165	1,019	2,475	2,883	3,260	3,178	4,048	4,219.
	P	1,057	1,674	1,077	2.478	2,407	3,154	3,535	4,081	4,231
	YPH	1,504	1,437	1,057	1,001	885	967	1.112	1.008	989

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TABLE ~~3.7~~ 15.2

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF GROUNDNUT BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	1	2	0.24	1	2	3	2	4	3
	P	2	1	0.36	1	1	4	3	2	4
	YPH	2,000	500	1,500	1,000	500	1,333	1,500	500	1,333
BAUCHI	AH	15	29	6	44	36	10	59	65	16
	P	13	9	4	32	26	6	45	35	10
	YPH	867	310	667	727	227	600	763	538	625
BENDEL	AH	0.07	-	-	2	2	1	2	2	1
	P	0.06	-	-	9	2	1	9	2	1
	YPH	857	-	-	4,500	1,000	1,000	4,500	1,000	1,000
BENUE	AH	3	2	3	16	23	15	19	25	18
	P	9	2	8	21	28	21	30	30	29
	YPH	3,000	1,000	2,667	1,313	1,217	1,400	1,579	1,200	1,611
BORNO	AH	43	16	15	113	3	1	156	19	16
	P	6	7	15	15	1	1	21	8	16
	YPH	140	438	1,000	133	333	1,000	135	421	1,000
C/RIVER	AH	0.10	-	-	-	-	-	0.10	-	-
	P	0.08	-	-	-	-	-	0.08	-	-
	YPH	800	-	-	-	-	-	800	-	-
GONGOLA	AH	7	8	9	13	26	29	20	34	38
	P	9	18	15	11	22	18	20	40	33
	YPH	1,286	2,250	1,667	846	846	621	1,000	1,176	868
IMO	AH	-	0.01	-	0.35	1	0.23	0.35	1	0.23
	P	-	0.00	-	0.21	1	0.15	0.21	1	0.15
	YPH	-	0	-	600	1,000	652	600	1,000	652
KADUNA	AH	4	1	8	107	70	170	111	71	178
	P	2	0.34	4	87	70	97	89	70	101
	YPH	500	340	500	813	1,000	571	802	986	567
KANO	AH	-	0.48	3	148	115	140	148	115	143
	P	-	0.46	1	90	70	97	90	70	98
	YPH	-	958	333	608	609	693	608	609	685
KWARA	AH	0.18	0.30	0.05	1	2	2	1	2	2
	P	0.09	0.35	0.07	1	2	2	1	2	2
	YPH	500	1,167	1,167	1,000	1,000	1,000	1,000	1,000	1,000
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	3	6	1	21	6	10	24	12	11
	P	3	2	1	11	3	8	14	5	9
	YPH	1,000	333	1,000	524	500	800	583	417	818
OGUN	AH	-	0.05	-	-	0.19	1	-	0.24	1
	P	-	0.02	-	-	0.09	1	-	0.11	1
	YPH	-	400	-	-	474	1,000	-	458	1,000
ONDO	AH	0.01	-	-	2	0.01	-	2	0.01	-
	P	0.003	-	-	3	0.004	-	3	0.004	-
	YPH	300	-	-	1,500	400	-	1,500	400	-
OYO	AH	0.004	1	1	0.01	0.16	3	0.01	1	4
	P	0.01	0.28	1	0.01	0.41	1	0.02	1	2
	YPH	2,500	280	1,000	1,000	2,563	333	2,000	1,000	500
PLATEAU	AH	3	2	1	18	7	4	21	9	5
	P	3	1	1	37	13	2	40	14	3
	YPH	1,000	500	1,000	2,056	1,857	500	1,905	1,556	600
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	5	1	4	80	136	210	85	137	214
	P	4	0.20	1	50	116	281	54	116	282
	YPH	800	200	250	625	853	1,333	635	847	1,318
TOTAL	AH	84	69	51	566	429	599	650	497	650
	P	51	42	51	368	356	540	419	396	591
	YPH	607	609	1,000	650	830	902	645	797	909

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TABLE 15.4

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF BEANS BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983 84	1981/82	1982/83	1983/84	1981/82	982/83	1983/84
ANAMBRA	AH	-	-	-	-	-	0.20	-	-	0.20
	P	-		-	-	-	0.023	-	-	0.023
	YPH	-	-	-	-	-	115	-	-	115
BAUCHI	AH	8	5	-	182	176	21	190	181	21
	P	1	1	-	82	99	7	83	100	7
	YPH	125	200	-	451	563	333	437	552	333
BENDEL	AH	-	-	-	-	-	0.18	-	-	0.18
	P	-	-	-	-	-	0.04	-	-	0.04
	YPH	-	-	-	-	-	222	-	-	222
BENUE	AH	1	0.39	0.02	7	6	2	8	6	2
	P	0.25	0.17	0.001	5	2	1	5	2	1
	YPH	250	436	50	714	333	500	625	333	500
BORNO	AH	24	5	6	20	146	52	44	151	58
	P	3	3	7	10	29	22	13	32	29
	YPH	125	600	1.167	500	199	423	296	212	500
C/RIVER	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
GONGOLA	AH	0.43	1	1	0.45	3	7	1	4	8
	P	0.16	1	0.20	0.07	0.38	3	0.23	2	2
	YPH	372	1,113	200	156	127	286	230	500	250
IMO	AH	-	-	-	-	-	-	-	-	-
	P	-		-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KADUNA	AH	1	1	2	261	294	321	262	295	323
	P	1	1	0.35	174	165	111	175	166	111
	YPH	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
KANO	AH	-	-	1	381	477	300	381	477	301
	P	-	-	1	128	172	71	128	172	72
	YPH	-	-	1,000	336	361	237	336	361	239
KWARA	AH	-	0.45	0.02	3	2	4	3	2	4
	P	-	0.11	0.001	4	1	1	4	1	1
	YPH	-	244	50	1,333	500	250	1,333	500	250
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	-	-	0.04	2	-	0.36	2	-	0.40
	P	-	-	0.13	0.25	-	0.23	0.25	-	0.36
	YPH	-	-	3,250	125	-	639	125	-	900
OGUN	AH	0.11	-	0.05	0.12	-	0.13	0.23	-	0.18
	P	0.19	-	0.02	0.32	-	0.10	1	-	0.12
	YPH	1,727	-	400	2,667	-	769	4,348	-	667
ONDO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
OYO	AH	-	-	-	0.012	-	-	0.012	-	-
	P	-	-	-	0.021	-	-	0.021	-	-
	YPH	-	-	-	1,750	-	-	1,750	-	-
PLATEAU	AH	0.11	-	0.14	1	4	5	1	4	5
	P	0.08	-	0.13	5	2	2	5	2	2
	YPH	727	-	929	5,000	500	400	5,000	500	400
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	-	1	-	281	399	460	281	400	460
	P	-	0.28	-	200	264	249	200	264	249
	YPH	-	280	-	712	662	541	712	660	541
TOTAL	AH	34	14	10	1,138	1,507	1,173	1,173	1,520	1,183
	P	5	7	9	609	734	466	615	741	475
	YPH	147	500	900	535	487	397	523	488	401

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TABLE ~~377~~: AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF YAM BY STATE AND NIGERIA

STATES		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	8	9	5	72	57	47	80	66	52
	P	48	162	111	507	463	307	555	626	418
	YPH	6,060	18,000	22,000	7,042	8.123	6,532	6,937	9,470	8,038
BAUCHI	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
BENDEL	AH	4	8	5	44	55	58	48	63	63
	P	47	81	47	393	451	505	440	532	552
	YPH	11,750	10,125	9,400	8,732	8,200	8,707	9,167	8,444	8,762
BENUE	AH	45	56	34	36	45	40	83	101	74
	P	796	537	350	537	469	339	1,333	1,006	689
	YPH	17,689	9,589	10,294	14,132	10,422	8.425	16,060	9,960	9,311
BORNO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
C/RIVER	AH	6	17	3	22	3	24	28	50	27
	P	54	191	16	130	169	163	184	360	179
	YPH	9,000	11,235	5.333	5,909	5,121	6,792	6,571	7,200	6,630
GONGOLA	AH	8	15	10	2	5	10	10	20	20
	P	51	219	77	11	49	76	62	268	153
	YPH	6,375	14,600	7.700	5.500	9,800	7,600	6,200	13,400	7,650
IMO	AH	3	1	1	31	26	49	34	27	50
	P	15	7	11	266	335	609	281	342	620
	YPH	5,000	7,000	11,000	8,581	12,885	12,429	8,265	12.667	12,400
KADUNA	AH	14	9	21	14	3	11	28	12	32
	P	68	114	121	126	13	162	194	127	283
	YPH	4,857	12.667	5,762	9.000	4,333	4,727	6,929	10,583	8,844
KANO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KWARA	AH	18	21	19	11	12	18	29	33	37
	P	183	376	176	107	109	175	290	485	351
	YPH	10,177	17,905	9.263	9,727	9.083	9,722	10,000	14,697	9,486
LAGOS	AH	0.01	0.02	0.10	0.04	0.005	-	0.05	0.03	0.10
	P	0.06	0.06	1	0.44	0.008	-	1	0.07	1.00
	YPH	6,000	3,000	10,000	11,000	1,600	-	20,000	2,333	10,000
NIGER	AH	29	23	32	5	3	1	34	26	33
	P	344	204	369	39	31	17	383	235	386
	YPH	11 862	8.870	11,531	7,800	10,333	10,000	11,265	9,038	11,697
OGUN	AH	0.24	1	1	1	0.15	0.47	1	1	1.09
	P	2	4	5	5	1	3	7	5	8
	YPH	8,333	4,000	5.000	5,000	6,667	6,383	7,000	5,000	7,339
ONDO	AH	8	13	9	9	15	13	17	28	22
	P	69	134	85	100	180	121	169	314	206
	YPH	8,625	10,308	9.444	11,111	12,000	9,308	9,941	11,214	9,364
OYO	AH	2	21	21	2	6	6	4	27	27
	P	24	178	226	22	110	60	46	288	286
	YPH	12,000	8,476	10,762	11,000	18,233	10,000	11.500	10,667	10,593
PLATEAU	AH	77	64	48	11	9	26	88	73	74
	P	1,176	1,157	482	75	76	265	1,251	1,233	747
	YPH	15,273	18,078	10,042	6,818	8.444	10.192	14,216	16,890	10.095
RIVERS	AH	0.16	2	0,22	5	7	12	5	9	12
	P	5	10	2	59	79	106	64	89	106
	YPH	31,250	5.000	9,090	11,800	11.266	8,833	12.800	9.889	8,838
SOKOTO	AH	0.22	-	-	-	-	-	0.22	-	-
	P	0.27	-	-	-	-	-	0.27	-	-
	YPH	1,257	-	-	-	-	-	1,250	-	-
TOTAL	AH	223	260	209	267	276	315	489	535	524
	P	2.882	3,374	2,079	2,377	2,535	2.908	5,260	5,909	4,987
	YPH	12,924	12,979	9,945	8,904	9.185	9,232	10,756	11,024	9,516

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15.6

TABLE ~~3-10~~

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF COTTON BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
BAUCHI	AH	1	3	6	1	-	3	2	3	9
	P	1	2	6	1	-	3	2	2	9
	YPH	1,000	662	1,000	1,000	-	1,000	1,000	667	1,000
BENDEL	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
BENUE	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
BORNO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
C/RIVER	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
GONGOLA	AH	1	4	0.06	-	-	-	1	4	0.06
	P	1	2	0.06	-	-	-	1	2	0.05
	YPH	1,000	500	833	-	-	-	1.000	500	833
I M O	AH	—	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KADUNA	AH	2	-	-	21	40	16	23	40	16
	P	3	-	-	17	84	22	20	84	22
	YPH	1,500	-	-	810	2.100	1,385	870	2,100	1,375
KANO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
KWARA	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	0.12	-	-	-	-	-	0.12	-	-
	P	0.10	-	-	-	-	-	0.10	-	-
	YPH	833	-	-	-	-	-	833	-	-
OGUN	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
ONDO	AH	-	-	-	0.02	-	-	0.02	-	-
	P	-	-	-	0.001	-	-	0.001	-	-
	YPH	-	-	-	50	-	-	50	-	-
OYO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
PLATEAU	AH	2	1	-	-	0.07	-	[illegible]	1	-
	P	6	1	-	-	0.05	-	6	1	-
	YPH	3,000	1,000	-	-	714	-	3.000	1,000	-
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	4	14	12	14	23	56	18	37	68
	P	3	13	10	7	18	67	10	31	77
	YPH	750	929	833	500	783	1,196	560	838	1,132
TOTAL	AH	10	22	18	36	63	75	46	86	93
	P	14	18	16	25	102	92	39	120	108
	YPH	1,400	818	889	694	1,619	1,227	848	1,412	1,161

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-TABLE 15·7

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF MAIZE BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
AMAMBRA	AH	-	0.09	0.23	13	23	34	13	23	34
	P	-	0.03	0.28	18	18	31	18	18	34
	YPH	-	333	1,217	1,385	783	912	1,385	783	914
BAUCHI	AH	29	15	33	81	92	10	110	107	43
	P	78	15	20	156	44	11	234	59	.31
	YPH	2,690	1,000	606	1,926	478	1,100	2,127	551	721
BENDEL	AH	1	1	0.16	35	44	58	36	44	58
	P	0.35	0.35	0.05	26	42	33	26	42	32
	YPH	350	700	313	742	955	569	722	955	568
BENUE	AH	5	17	23	3	26	37	8	37	60
	P	5	15	34	29	56	31	34	71	65
	YPH	1,000	1,364	1,478	9,667	2,154	838	4,250	1,919	1,083
BORNO	AH	2	2	222	-	-	-	2	2	222
	P	2	2	138	—	-	-	2	2	138
	YPH	1,000	1,000	622	-	-	-	1,000	1,000	622
C/RIVER	AH	0.003	0.05	0.07	8	11	10	8	11	10
	P	0.003	0.04	0.05	7	12	5	7	12	5
	YPH	1,000	800	714	875	1,091	500	875	1,091	500
GONGOLA	AH	15	25	19	18	30	21	33	55	40
	P	31	38	22	23	44	37	54	82	59
	YPH	2,067	1,520	1,158	1,278	1,467	1,762	1,636	1,491	1,475
IMO	AH	0.01	-	0.24	21	20	50	21	20	50
	P	0.01	-	0.05	22	20	39	22	20	39
	YPH	1,000	-	208	1,048	1,000	780	1,048	1,000	777
KADUNA	AH	16	33	34	59	61	172	75	94	206
	P	17	54	39	34	49	150	51	103	189
	YPH	1,063	1,636	1,147	576	803	872	680	1,096	917
KANO	AH	3	13	1	27	10	25	30	23	26
	P	5	13	1	57	7	22	62	20	23
	YPH	1,667	1,000	1,000	2,111	700	880	2,067	870	885
KWARA	AH	4	4	1	18	31	32	22	35	33
	P	13	4	1	22	62	41	35	66	42
	YPH	3.250	1,000	1,000	1,222	2,000	1,281	1,591	1,886	1,273
LAGOS	AH	0.09	0.06	0.14	1	1	0.19	1	1	0.33
	P	1	0.05	0.06	0.47	0.08	0.08	1	0.13	0.14
	YPH	1,111	833	429	470	800	421	1,224	125	424
NIGER	AH	3	1	2	30	12	14	33	13	16
	P	1	0.43	3	21	10	15	22	11	18
	YPH	333	430	1,500	700	833	1,071	86	840	1,125
OGUN	AH	2	2	3	6	4	11	8	6	14
	P	2	1	2	9	6	14	11	7	16
	YPH	1,000	500	667	1,500	1,500	1,273	1,375	1,167	1,143
ONDO	AH	2	2	4	5	11	19	7	13	23
	P	3	1	14	20	4	16	23	5	30
	YPH	1,500	500	3,500	4,000	364	842	3,285	385	1,304
OYO	AH	8	15	19	11	22	24	19	37	43
	P	12	22	32	12	36	38	24	58	70
	YPH	1,500	1,467	1,684	1,091	1,636	1,583	1,263	1,567	1,628
PLATEAU	AH	—	-	11	-	-	82	-	-	93
	P	-	-	19	-	-	84	-	-	103
	YPH	-	-	1,727	-	-	1,024	-	-	1,108
RIVERS	AH	-	-	-	2	4	13	2	4	13
	P	-	-	-	2	10	59	2	10	59
	YPH	-	-	-	1,000	2,500	4,538	1,000	2,500	4,538
SOKOTO	AH	6	1	5	4	39	68	10	31	73
	P	7	0.27	7	4	40	68	11	40	75
	YPH	1,170	270	1,400	1,000	1,333	1,000	1,100	1,290	1,027
TOTAL	AH	96	125	376	342	431	680	438	556	1,058
	P	177	166	332	462	460	694	639	626	1,027
	YPH	1,844	1,329	880	1,352	1,068	1,021	1,460	1,126	970

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TABLE ~~[illegible]~~ 15.8

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF CASSAVA, (OLD) BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	4	4	14	0.02	-	-	4	4	14
	P	28	72	88	0.15	-	-	28	72	88
	YPH	7,000	18,000	6,286	7,500	-	-	7,000	18,000	6,286
BAUCHI	AH	-	-	0.89	0.06	-	-	0.06	-	1
	P	-	-	4	0.10	-	-	0.10	-	4
	YPH	-	-	4,494	1,667	-	-	1,667	-	4,000
BENDEL	AH	14	14	18	1	1	1	15	15	19
	P	116	125	214	23	7	2	139	132	216
	YPH	8,286	8,929	11,889	23,000	7,000	2,000	9,267	8,800	11,368
BENUE	AH	4	4	10	8	15	4	12	19	14
	P	31	58	143	36	76	17	67	134	160
	YPH	7,750	14,500	14,300	4,500	6,066	4,250	5,583	7,052	11,429
BORNO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
C/RIVER	AH	4	4	7	0.13	0.23	0.40	4	4	7.40
	P	28	35	55	0.48	2	4	29	37	59
	YPH	7,125	8,750	,857	3,692	8,696	10,000	7,250	9,250	7,973
GONGOLA	AH	3	4	2	0.32	-	-	3	4	2
	P	49	25	22	1	-	-	13	25	22
	YPH	4,000	6,250	11,000	3,125	-	-	4,333	6,250	11,000
IMO	AH	7	9	19	1	1	-	8	10	19
	P	49	96	196	7	16	-	56	112	196
	YPH	1,000	10,667	1,031	7,000	9,286	-	7,000	11,200	10,316
KADUNA	AH	-	-	-	0.12	-	-	0.12	-	-
	P	-	-	-	3	-	-	3	-	-
	YPH	-	-	-	25,000	-	-	25,000	-	-
KANO	AH	7	1	2	—	-	-	7	1	2
	P	20	8	5	-	-	-	20	8	5
	YPH	2,857	8,000	2,500	-	-	-	2,857	8,000	2,500
KWARA	AH	2	4	0.06	0.17	-	2	2	4	2
	P	21	26	0.06	1.67	-	2	23	26	2
	YPH	10,500	6,500	1,000	9,824	-	1,000	11,500	6,500	1,000
LAGOS	AH	0.14	0.30	0.20	0.04	-	-	0.18	0.30	0.20
	P	1	2	1	0.02	-	-	1	2	1
	YPH	7,142	6,667	5,000	-,000	-	-	5,556	6,667	5,000
NIGER	AH	0.10	-	-		-	0.13	0.10	-	0.13
	P	0.88	-	-	-	-	1	1	-	1
	YPH	8,800	-	-	-	— -	6,385	10,000	-	7,692
OGUN	AH	0.51	1	0.97	1	0.05	0.11	2	1	1
	P	4	11	13	0.84	0.14	0.28	5	11	13
	YPH	7,843	11,000	13,402	840	2,800	2,545	2,500	11,000	13,000
ONDO	AH	3	4	3	0.10	1	0.11	3	5	3
	P	38	59	29	1	13	1	39	72	30
	YPH	12,667	14,750	9,667	10,000	13,000	8,182	13,000	14,400	10,000
OYO	AH	4	5	14	0.72	0.42	1	5	5	15
	P	65	177	223	3	6	28	68	183	251
	YPH	16,250	35,400	15,929	4,167	14,286	28,000	13,600	36,600	16,733
PLATEAU	AH	-	0.17	0.20	1	-	-	1	0.17	0.20
	P	-	4	0.70	0.50	-	-	1	4	1
	YPH	-	23,529	3,500	500	-	-	1,000	23,529	500
RIVERS	AH	4	7	8	0.77	1	-	5	8	8
	P	78	81	125	11	10	-	89	91	125
	YPH	19,500	11,571	15,625	14,286	10,000	-	17,800	11,375	15,625
SOKOTO	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
TOTAL	AH	57	51	99	14	20	8	71	80	108
	P	492	779	1,119	89	130	55	582	909	1,174
	YPH	8,632	12,770	11,303	6,357	6,500	6,612	8,197	11,296	10,870

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TABLE 15.9

AREA HARVESTED, PRODUCTION AND YIELD PER HECTARE OF RICE BY STATE AND NIGERIA

STATE		SOLE			MIXED			TOTAL		
		1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
ANAMBRA	AH	13	3	0.37	1	-	-	14	3	0.37
	P	15	28	2	5	-	-	20	28	2
	YPH	1,154	9,333	5,405	5.000	-	-	1,429	9.333	5,405
BAUCHI	AH	2	1.20	0.96	1	-	3	3	1	4
	P	5	1.00	1.43	1	-	1	6	1	2
	YPH	2,500	833	1,490	1,000	-	333	2,000	1,000	500
BENDEL	AH	2	1	-	1	1	0.47	3	2	0.47
	P	19	1	-	2	0.44	0.45	21	1	0.45
	YPH	9,500	1,000	-	2,000	440	957	7,000	500	957
BENUE	AH	3	5.28	3	6	2.25	3	9	8	6
	P	5	10.16	8	6	4.00	5	11	14	13
	YPH	1,667	1,924	2,677	1,000	1,778	1,667	1,222	1,750	2,167
BORNO	AH	13	52	-	-	-	-	13	552	-
	P	32	110	-	-	-	-	32	110	-
	YPH	2,462	2,115	-	-	-	-	2,462	2,115	-
C/RIVER	AH	-	0.08	0.12	-	-	-	-	0.08	0.12
	P	-	0.02	0.08	-	-	-	-	0.02	0.08
	YPH	-	250	667	-	-	-	-	250	667
GONGOLA	AH	-	1	0.48	0.91	2	0.22	0.91	3	0.70
	P		4	0.24	3.	3	0.04	3	7	0.28
	YPH	-	4,000	500	3,297	1,500	182	3,297	2.333	400
IMO	AH	13	-	5	0.03	-	-	13	-	5
	P	38	-	29	0.07	-	-	38	-	29
	YPH	2,923	-	5,800	2,323	-	-	2,923	-	5,800
KADUNA	AH	11	-	-	5.	-	-	16	-	-
	P	12	-	-	13	-	-	25	-	-
	YPH	1,091	-	-	2,600	-	-	1,562	-	-
KANO	AH	2	1	-	0.55	0.23	0.39	3	1	0.39
	P	1	0.46	-	0.14	0.10	0.12	1	1	0.12
	YPH	500	460	-	255	435	308	333	1,000	308
KWARA	AH	-	0.09	22	0.01	0.11	-	0.01	0.20	22
	P	-	0.23	29	0.02	0.35	-	0.20	1	29
	YPH	-	2,556	1,318	2,000	3,182	-	2,000	5,000	1,318
LAGOS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
NIGER	AH	7	8	4	0.09	3	-	7	11	4
	P	7	15	6	0.31	1	-	7	16	6
	YPH	1,000	1,875	1,500	3,444	333	-	1,000	1,455	1,500
OGUN	AH	0.17	0.04	-	1	0.46	1	1	1	1
	P	0.12	0.08	-	1	0.34	2	1	0.42	2
	YPH	706	2,000	-	1,000	739	2,000	1,000	420	2,000
ONDO	AH	5	8	4	-	-	-	5	8	4
	P	11	18	9	-	-	-	11	18	9
	YPH	2,200	2,250	2,250	-	-	-	2,200	2,250	2,250
OYO	AH	0.05	-	-	-	-	-	0.05	-	-
	P	0.17	-	-	-	-	-	0.17	- -	-
	YPH	3,400	-	-	-	-	-	3,400	-	-
PLATEAU	AH	3	3	1	0.23	0.30	-	3	3	1
	P	4	5	1	0.15	0.09	-	4	5	1
	YPH	1,333	1,667	1,000	652	300	-	1,250	1,667	1,000
RIVERS	AH	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	-	-	-	-	-
	YPH	-	-	-	-	-	-	-	-	-
SOKOTO	AH	0.12	-	-	0.40	2	4	1	2	4
	P	0.21	-	-	0.08	0.17	5	0.29	0.17	5
	YPH	1,750	-	-	200	85	1,250	290	85	1,250
TOTAL	AH	74	84	41	17	11	12	92	95	53
	P	150	193	85	32	9	14	180	203	99
	YPH	2,027	2,293	2,073	1,882	818	1,167	1,957	2.137	1,868

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CHAPTER VI

FARM LABOUR

This chapter presents the analysis of the data collected on farm labour in February, 1983. The reference period was one week.

6.1 AGE-SEX DISTRIBUTION:

The age and sex distribution of those employed on the farm is given below.

% Distribution of Farm Workers by Age Group and by Sex, February, 1983

Age Group	Male	Female	Both Sexes
Below 15	9.37	9.54	9.42
15-29	35.26	38.84	36.37
30-44	30.45	34.60	31.73
45-59	17.74	13.14	16.32
60 and Over	7.18	3.88	6.16
Total	100.00	100.00	100.00
Total Workers ('000)	8,998	3,998	12,996

The table indicates that almost one tenth of the 13.0 million workers on the farm, were aged below 15 years. Also persons aged 60 years and above constituted 6% of total farm labour. It is of interest to note that in the labour force concept, these two groups are outside the labour force.

The bulk of those employed on the farm are between the ages 15 and 44. This age bracket accounts for about two thirds (68%) of total farm labour; 16% are in the age group 45-59 years.

The figures also indicate that 69% of total farm workers are males and the remaining 31% were females.

6.2 EMPLOYMENT STATUS OF FARM WORKERS:

The table below gives the employment status of farm workers.

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Distribution of Farm Workers by Employment Status and by Sex, February, 1983

Employment Status	Male	Female	Total
Farmer	4,324	448	4,772
Unpaid Family Members	2,851	3,055	4,906
Paid Employees	1,820	498	2,318
Total	8,995	4,001	12,996

2.3 million which was about one sixth of all farm workers, were paid employees, whereas, 4.8 million were the farmers themselves while their family members engaged on the farm totalled 5.9 million. About four fifths of the paid employees were male while the remaining one fifth were females. In respect of the unpaid family workers, the males were about two third while the females were about one third.

HOURS OF WORK:

Overall paid employees worked for about 23 hours a week while unpaid family workers worked for about 30 hours a week. These figures are given in the table below. February is generally not the peak period of work for agricultural work hence the low level of hours of work.

Average Hours of Work Per Week by Category of Farm Workers and by Sex, February, 1983

Hours

Category of Farm Worker	Male	Female	Both Sexes
Paid Employees	22.3	24.2	22.7
Unpaid Family Workers			
- Farmer	30.4	25.8	29.5
- Other Members	21.3	19.0	20.1

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6.4 WAGE RATES FOR PAID FARM LABOURERS:

The table below indicates that on the average, a farm labourer was paid ₦0.53 per hour, but male farm labourers earned a little more than female farm labourers. Average wage per week was found to be ₦12.37 for males, and ₦10.36 for females while the average for both sexes was ₦11.93.

Average Wages (₦) for Paid Employment, February, 1983

Sex	Wages Per Hour	(₦) Wages Per Week
Male	0.56	12.37
Female	0.43	10.36
Both Sexes	0.53	11.93

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CHAPTER IV

LIVESTOCK PRODUCTION

The survey also covered the domestic livestock production in the rural areas of Nigeria. Livestock includes poultry and animals. Poultry consists of chickens, guinea fowls, ducks, geese and turkeys while animals include goats, sheep, cattle, pigs, donkeys, horses and camels.

4.1 POULTRY:

Each of the nineteen states of the federation contributed substantially to the production of poultry. As at December 1982, the production figure was 71.2 million, while in December 1983 the figure was 82.1 million (see Table 4.1).

Kano State had the highest figure of 17.3 million birds in December 1983, representing about 21% of national production. Other major producers were Kaduna and Sokoto States. The three states combined produced 43.5 million birds in December 1983, which represented about 53% of national production. Generally, these states have over the years remained the highest producers.

Lagos State recorded the lowest production figure in December 1983 as it did in December 1982. The 1983 figure was 8,000 while that of 1982 was 18,000. Details are contained in Table 4.3.

Comparing figures for December 1982 with those of December 1983, one can say that Benue, Borno, Lagos, Ogun, Ondo and Plateau States recorded declined in production, but the other thirteen states reported increases.

4.2 ANIMALS:

Table 4.1 presents production figures (June and December) for each type of livestock. Goat is seen to be the most important animal in terms of numbers. In December 1983 for instance, its production was 36.7 million, representing about 59% of all animals. About the same percentage was recorded in both 1982 and 1981.

Next was sheep, which in the last three years accounted for about 25% of all animals.

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TABLE 4.1

ESTIMATED TOTAL NUMBER OF LIVESTOCK IN NIGERIA AS AT JUNE AND DECEMBER 1983

'000

LIVESTOCK	JUNE			DECEMBER		
	1981	1982	1983	1981	1982	1983
POULTRY	46,530	43,786	50,269	70,424	71,214	82,148
GOATS	23,667	22,947	28,743	27,944	28,851	36,745
SHEEP	9,454	10,647	13,824	11,402	13,687	15,664
CATTLE	5,829	6,256	6,830	6,557	7.494	7,804
PIGS	480	658	535	557	672	658
DONKEYS	897	1,130	1,33	932	1,200	1,371

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The least produced animal was pig which accounted for only 1% of all animals.

Table 4.2 shows the contributions of the states to national production figures of animals in December 1983. Sokoto, Kano and Kaduna States were the three leading producers of goats and sheep, accounting for about 65% and 68% respectively of national estimates. Other major producers were Bauchi and Borno States.

In the case of cattle, the leading producer was Sokoto with 2.4 million, representing about 31% of national figure. Other major producers (above 1 million heads) were Bauchi, Borno, Kaduna and Kano. All four combined accounted for about 4.5 million heads, representing about 58% of national figure.

Of the 658,000 pigs produced in December 1983, 421,000 about 64% came from three states; Bendel, Gongola and Kaduna. Though produced by seven states, donkey production was dominated by three states namely Sokoto, Kano and Kaduna. Of the total national production of 1.4 million or about 93%.

Judging by the December stocks in Table 4.1, steady increases were recorded for all animals between 1981 and 1983. The number of goats increased from 28.9 million in 1981 to 36.7 million in 1983, representing an increase of about 27%. The percentage increase in number of sheep was even higher; from 11.4 million in 1981 to 15.7 million in 1983, representing a 37% increase. The highest percentage increase of about47% was recorded in the case of donkey (from 0.9 million in 1981 to 1.4 million in 1983). Other animals registered lesser increases. Taking all animals together, the number of heads increased from 47.4 million in 1981 to 62.2 million in 1983, representing about 31% increase.

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TABLE 4.2

ESTIMATED NUMBER OF DOMESTIC LIVESTOCK AS AT DECEMBER 1983 BY KIND AND STATE

STATE LIVESTOCK	ANAMBRA	BAUCHI	BENDEL	BENUE	BORNO	C/RIVER	GONGOLA	IMO	KADUNA	KANO	KWARA	LAGOS	NIGER	OGUN	ONDO	OYO	PLATEAU	RIVERS	SOKOTO	TOTAL
POULTRY	5,094	7,202	2,143	2,373	4,147	611	2,496	6,224	13,274	17,255	989	8	1,660	211	564	1,660	2,851	268	12,950	82,148
GOATS	1,194	3,479	451	465	2,878	286	1,032	938	4,547	8,793	366	1	419	47	126	354	774	71	10.554	36,745
SHEEP	316	1,400	43	104	1,923	41	348	222	2,693	4,804	255	0.26	39	13	11	36	329	15	3,172	15,664
CATTLE	25	1,057	-	1	1,217	-	577	-	1,250	1,010	31	-	40	5	0.69	-	156	-	2.435	7804.69
PIGS	15	10	171	39	3	-	125	0.39	125	-	-	0.24	14	11	39	7	98	0.34	-	658
DONKEYS	-	55	-	-	42	-	-	-	221	381	-	-	2	-	-	-	2	-	668	1,371
HORSE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAMEL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Contract Paper No. 8

DRAFT

The Role of Low-Resource Agriculture in Africa: Senegal: Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW RESOURCE AFRICAN AGRICULTURE

SENEGAL Supplementary Information

1. Production Statistics

a. Figure 1 is a map of Senegal showing the location of agroecological zones in the country in relationship to the different provinces (regions). Table 1 shows national aggregates of major crops for 1961-84, while Tables 2-9 are regional production statistics (by crop) for 1961-84.

c. Agriculture's share of GDP has varied from 13.3% in 1982 to 7% in 1984. Table 10 shows the share of GDP by subsector for 1976-84.

c. The volume and value of selected agricultural exports is seen in Table 11, while Table 12 shows the balance of trade for 1984.

2. Producers

To our knowledge, there have been no recent national surveys to estimate the numbers and distribution of agricultural producers. An FAO study titled, "Women in Food Production and Food Security in Africa," authored by Jennie Day and published in 1984 shows that in 1970, 43.7% of the agricultural labor force was constituted by women. The same study showed that 89% of economically active women were in the agricultural sector. Another study by the same author titled "Women in Rice Farming Systems in Sub-Saharan Africa," published by FAO in 1984 stated that in irrigated rice production in Senegal, females are the main cultivators , they have control of the rice household crop and their own personal crop.

The division of labor of agricultural tasks varies by ethnic group. For example, in the peanut basin, Wolof, women and their sons could control up to 50% of the peanut area grown. Women have specific responsibilities related to agricultural tasks. These include planting, weeding, and threshing. Male heads of households work in the family fields while women work in their personal fields in addition to family fields.

3. Method of Production

a. Irrigated/rainfed

The extent of irrigated production varies by crop. Figure 2_ shows the location of main irrigation developments while Table 13__ shows area and production of crops under irrigation in different schemes.

b. Types and amounts of commercial inputs

Chemical fertilizer is a major commercial input which is distributed by the government and used on peanuts. But as millet is also grown in the peanut basin, chemical fertilizer is also applied on millet. The amount of fertilizer distributed and its value is shown in Table 14__.

c. Intercropping/sole cropping

Intercropping is predominant in the ASA zone as in the Sahelian countries. Sole cropping is practiced in the irrigated areas. Millet/sorghum is a common intercropped mixture.

4. Consumption and Storage

As seen earlier in Table 12, Senegal imports rice, wheat, and sugar. Peanuts and cotton, together with fish are export commodities. There are no national surveys which detail levels of on-farm storage which are available. But, modern storage facilities are available in the agricultural project areas and for peanuts.

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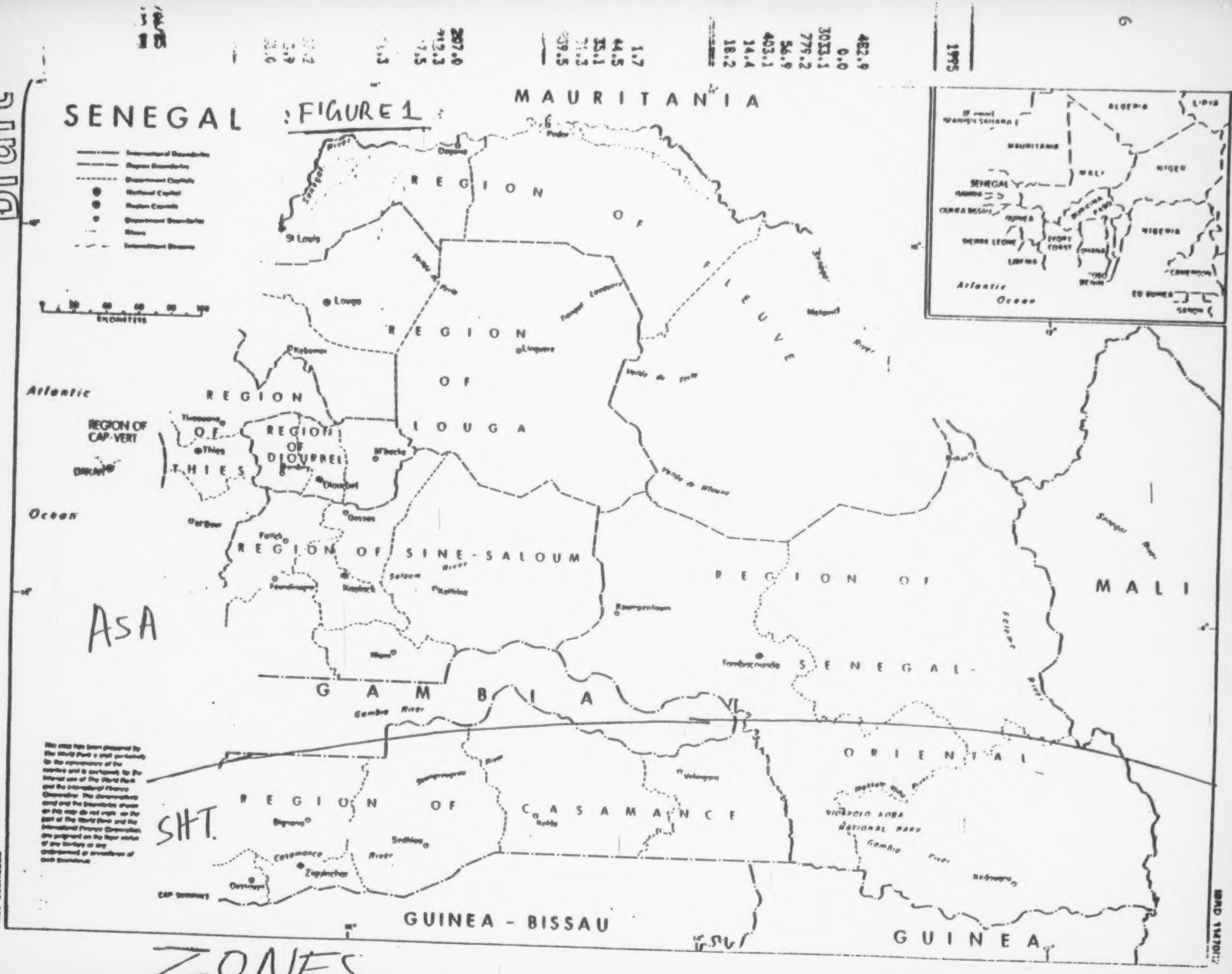
SENEGAL : FIGURE 1


International Boundaries
Region Boundaries
National Capital
Region Capitals
Department Boundaries
Rivers
Intermittent Streams
KILOMETERS
MAURITANIA
REGION OF FLEUVE
St Louis
Dagana
Podor
Senegal River
Matam
REGION OF LOUGA
Louga
Linguere
Kebemer
Atlantic Ocean
REGION OF CAP-VERT
DAKAR
REGION OF THIES
Thies
Tivaouane
M'Bour
REGION OF DIOURBEL
Diourbel
Bambey
M'Backe
REGION OF SINE-SALOUM
Fatick
Foundiougne
Kaolack
Gossas
Kaffrine
Nioro
Koungheul
Saloum River
Kaffrine
REGION OF SENEGAL-ORIENTAL
Tambacounda
Bakel
Kedougou
Niokolo Koba National Park
Gambia River
Faleme River
GAMBIA
Gambia River
REGION OF CASAMANCE
Ziguinchor
Oussouye
Bignona
Sedhiou
Kolda
Velingara
Casamance River
CAP SKIRRING
GUINEA - BISSAU
GUINEA
MALI
ASA
SHT
SPANISH SAHARA
MAURITANIA
MALI
ALGERIA
NIGER
SENEGAL
GAMBIA
GUINEA BISSAU
GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GHANA
TOGO
BENIN
NIGERIA
CAMEROON
EQ GUINEA
Atlantic Ocean
IBRD 11470

ZONES

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[illegible]

TABLE 1: SENEGAL: Production of Major Crops 1961 - 1984

ar 1/	PEANUTS		MILLET/SORGHUM		RICE		CORN		NIEBE		COTTON		Total cultivated Area (1000 ha) 2/	
	Production (1000 Tons)	Area Planted (1000 Ha)	Production (1000 Tons)	Area Planted (1000 Ha)	Production (1000 Tons)	Area Planted (1000 Ha)	Production (1000 Tons)	Area Planted (1000 Ha)	Production (1000 Tons)	Area Planted (1000 Ha)	Production (1000 Tons)	Area Planted (1000 Ha)		
1	922.5	977.0	392.3	683.2	71.2	67.8	27.4	30.6	28.7	45.2	0.08	0.99	1,804.79	(48.4)
2	992.8	1025.5	406.6	839.8	83.5	73.4	28.4	32.0	15.1	56.2	0.11	1.01	2,027.91	(54.4)
3	893.9	1013.0	423.7	864.7	89.9	71.5	26.8	31.5	12.8	49.3	0.11	0.87	2,030.87	(54.5)
4	952.4	1084.2	479.4	959.5	105.2	74.3	26.7	32.7	14.2	51.3	0.29	2.14	2,204.14	(59.1)
5	1019.3	1055.0	513.8	1010.8	108.3	86.3	37.1	47.2	16.8	56.3	0.52	1.69	2,257.29	(60.5)
6	1122.1	1112.1	560.1	1069.4	121.9	82.1	40.8	54.2	13.7	53.5	0.70	1.45	2,372.75	(63.6)
7	857.1	1114.1	423.5	996.7	124.7	87.2	41.8	53.9	18.2	68.8	1.92	2.28	2,322.98	(62.3)
8	1005.2	1163.8	655.0	1155.5	133.9	100.8	56.8	71.7	30.4	99.2	4.27	4.04	2,595.04	(69.6)
9	819.5	1193.1	449.3	1053.6	61.1	76.9	25.3	36.4	17.1	67.8	9.75	6.69	2,434.49	(65.3)
0	788.8	963.1	634.7	1037.3	140.1	103.7	48.9	55.4	22.5	71.2	11.50	9.81	2,240.51	(60.1)
1	582.0	1049.7	382.0	966.5	93.1	89.3	33.1	50.8	17.7	63.1	11.61	13.62	2,233.02	(59.9)
2	985.4	1060.4	583.2	970.4	107.5	84.0	37.6	48.8	25.9	71.0	21.16	18.33	2,252.93	(60.4)
3	570.0	1071.4	322.0	936.1	37.9	53.3	20.2	32.4	10.8	86.4	23.31	20.36	2,199.96	(59.0)
4	657.0	1025.1	510.2	1102.9	65.2	64.8	33.8	39.2	15.2	52.9	32.61	28.12	2,012.02	(54.0)
5	980.7	1052.2	796.2	1144.7	120.4	85.2	43.2	48.6	22.3	56.4	40.60	37.96	2,425.06	(65.0)
6	1434.1	1312.5	616.4	964.5	130.2	93.5	44.4	50.1	24.8	60.8	30.69	39.21	2,520.61	(67.6)
7	1186.3	1295.1	507.6	948.9	126.0	88.6	43.5	48.6	16.2	63.4	45.22	41.85	2,476.45	(66.4)
8	509.3	1161.2	360.2	942.8	63.0	63.3	33.2	53.6	11.7	57.2	37.17	47.11	2,325.21	(62.4)
9	1050.7	1154.3	752.0	1054.7	146.4	91.3	54.1	56.4	18.2	62.4	33.81	48.31	2,467.41	(66.2)
0	672.9	1047.9	520.6	967.5	96.6	78.7	46.2	67.7	18.8	55.4	27.23	30.91	2,248.11	(60.3)
1	521.3	1064.6	545.0	1116.7	64.7	67.1	57.0	78.4	17.1	54.3	20.96	29.92	2,411.02	(64.7)
2	869.9	1010.1	736.4	1176.9	120.0	69.1	69.0	55.8	28.8	68.5	33.72	39.28	2,419.68	(64.9)
3	1091.7	1121.1	585.2	990.9	105.2	68.2	82.2	86.2	12.6	50.3	43.66	36.07	2,352.77	(63.1)
4	568.8	987.5	351.8	782.6	108.5	52.0	60.6	70.5	19.9	39.4	31.00	33.36		

SOURCES: Computed by the author from Tables 2 thru 9.

E: 1/ The year refers to the crop year; i.e., 1961 refers to the crop year 1960/61: Planting mid 1960, harvest end 1960.

2./ Figures in parentheses represent the percentage of total arable land areas under cultivation. The total arable land areas are estimated to be 3,728,000 hectares (see Sixth Development Plan). Production in thousands, tons and area in thousands hectares

3/ Estimates

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TABLE 2: Agricultural Productivity in the CAP-VERT Region: Production, Yields and Areas of Major Crops 1961 - 1984

([illegible])

Year 1/	PEANUT			MILLET/SORGHUM			RICE		CORN			NIEBE			COTTON			Rainfall	
	Production	Yield 3/	Area	Production	Yield	Area	Production	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	mm's	index2/
1961	3.5	1,000	3.5	0.6	375	1.6	-	-	-		-	-		0.25	-		-	582	118
62	3.0	600	5.0	0.6	375	1.6	-	-	-		-	-		—	-		-	586	119
63	2.1	700	3.0	0.6	375	1.6	-	-	-		-			0.18	-		-	577	117
64	2.2	344	5.4	0.2	250	0.8	-	-	-		-	-		0.21	-		-	547	111
65	1.9	452	4.2	0.3	333	0.9	-	-	-		-	0.10	417	0.24	-		-	531	108
66	2.4	600	4.0	0.3	300	1.0	-	-	-		-	0.11	367	0.30	-		-	400	81
67	2.0	556	3.6	0.4	400	1.0	-	-	-		-	0.14	368	0.38	-		-	515	105
68	3.2	627	5.1	0.5	455	1.1	-	-	-		-	0.18	429	0.42	-		-	918	187
69	0.7	250	2.8	0.1	143	0.7	-	-	-		-	-	-	-	-		-	208	42
70	2.0	800	2.5	0.7	500	1.4	0.6	2.3	-		-	0.16	444	0.36	-		-	687	140
71	1.0	263	3.8	1.0	435	2.3	-	-	-		-	0.14	389	0.36	-		-	196	40
72	4.2	857	4.9	0.7	778	0.9	-	-	-		-	0.19	452	0.42	-		-	410	83
73	-	0	2.0	-	0	0.3	-	-	-		-	-		-	-		-	120	24
74	0.5	238	2.1	1.1	1571	0.7	-	-	-		-	-		0.10	-		-	964	196
75	1.0	500	2.0	1.4	700	2.0	-	-	-		-	-		0.10	-		-	367	75
76	2.0	800	2.5	1.3	591	2.2	-	-	-		-	-		0.12	-		-	675	137
77	0.5	357	1.4	0.5	455	1.1	-	-	-		-	-		0.20	-		-	392	80
78	-	-	-	0.1	111	0.9	-	-	-		-	-		0.10	-		-	158	32
79	0.8	800	1.0	0.3	500	0.6	-	-	-		-	-		-	-		-	269	55
80	0.4	444	0.9	0.2	400	0.5	-	-	-		-	-		-	-		-	260	53
81	1.2	1200	1.0	0.9	563	1.6	-	-	0.2		0.2	-		0.10	-		-	378	77
82	1.0	714	1.4	-		-	-	-	-		-	-		0.10	-		-	340	69
83	1.3	867	1.5	0.6	545	1.1	0.01	- 0.2	-		-	0.04	267	0.15	-		-	331	67
84			0.9	-		0.14					0.07			0.01					

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Sources: Ministry of Rural Development, Ministry of Equipment (for rain data)

Note: 1 / See Table 1

2/ Rain indices calculated, based on rain data from 33 stations. 1951 - 80 = 100

3/ Calculated. Production in thousands tons, yield in Kg/Ha and Area planted in thousands hectares

TABLE 3: Agricultural Productivity in the CASAMANCE Region:
Production, Yields and Areas of Major Crops 1961 - 1984

PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall	
Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Produc-	Yield	Area	Index 2/ mm's	Index 2/
112.8	910	123.9	62.1	858	72.4	52.1	990	52.6	13.1	985	13.3	–		–	–	–	0.85	1079	86
118.0	937	126.0	62.0	769	80.6	60.0	1,126	53.3	13.1	956	13.7	–		0.10	0.09	106	0.85	1253	99
120.1	1,090	110.2	68.3	878	77.8	67.0	1,203	55.7	11.8	959	12.3	–		–	–	–	0.80	1319	105
125.0	1,134	110.2	72.5	839	86.4	77.5	1,345	57.6	12.1	877	13.8	—		–	0.19	95	2.00	1219	97
130.0	1,254	103.7	83.7	813	102.9	80.9	1,191	67.9	16.2	910	17.8	–		–	0.15	152	0.99	1310	104
132.4	1,116	118.6	94.4	840	112.4	88.3	1,448	61.0	19.2	850	22.6	0.14	311	0.45	0.16	267	0.60	1458	116
126.8	1,046	121.0	76.0	861	88.3	82.2	1,259	65.3	19.9	905	22.0	0.27	388	0.80	1.19	1,240	0.96	1251	99
120.0	1,000	120.0	114.0	911	125.1	101.1	1,288	78.5	32.1	953	33.7	0.40	354	1.13	0.77	494	1,56	1560	124
103.5	895	115.6	88.0	779	113.0	43.0	789	54.5	16.6	765	21.7	0.37	322	1.15	1.82	1,542	1.18	830	66
91.7	776	118.1	121.4	1,002	121.2	105.6	1,248	84.6	28.2	953	29.6	0.99	444	2.23	2.68	1,506	1.78	1198	95
114.3	997	114.7	100.2	812	123.4	68.5	919	74.5	18.5	734	25.2	0.79	391	2.02	4.09	1,303	3.14	1136	90
129.1	1,031	125.2	90.9	986	92.2	73.0	1,118	65.3	16.2	831	19.5	0.40	301	1.33	7.69	1,321	5.82	983	78
114.3	1,148	99.6	74.8	789	94.8	27.7	791	35.0	9.7	746	13.0	0.37	200	1.85	9.85	1,449	6.80	702	56
113.3	1,055	107.4	83.7	843	99.3	49.2	990	49.7	13.9	986	14.1	0.48	379	1.29	16.66	1,449	11.50	1118	89
115.2	943	122.2	101.9	1,067	95.5	86.4	1,354	63.8	16.5	1,078	15.3	1.01	510	1.98	17.05	1,084	15.73	1110	88
147.7	1,081	136.6	74.1	817	90.7	97.4	1,374	70.9	14.9	1,096	13.6	1.09	433	2.52	10.89	665	16.38	1322	105
135.1	1,156	106.9	75.9	833	91.1	88.4	1,358	65.1	19.4	1,213	16.0	0.37	402	0.92	20.99	1,160	18.10	1282	102
87.3	858	101.8	64.6	740	87.3	34.1	814	41.9	11.4	713	16.0	0.39	386	1.01	23.54	1,168	20.15	813	65
139.1	1,008	138.0	30.8	298	103.2	108.4	1,510	71.8	19.1	838	22.8	1.53	495	3.09	17.06	755	22.60	1258	100
89.5	840	106.6	81.4	779	104.5	56.8	983	57.8	23.5	911	25.8	0.80	266	3.01	12.96	993	13.05	968	77
36.3	472	76.9	58.8	565	104.1	26.8	550	48.7	19.1	783	24.4	0.75	347	2.16	11.49	779	14.75	760	60
97.3	1,099	88.5	79.6	804	99.0	76.7	1,348	56.9	23.7	801	29.6	0.94	463	2.03	15.90	686	23.19	1122	89
112.0	1,256	89.2	90.8	949	95.7	55.1	1,095	50.3	22.8	894	25.5	1.48	503	2.94	33.16	1,355	24.47	1389	110
106.9	1,186	89.5	67.6	802	84.3	35.8	1,126	31.8	35.4	1,314	27.0	1.40	483	2.90	29.50	1,150	09.47		

Sources: Same as for Table 2

Note: 1/, 2/, 3/ See table 2
4/ Estimates (soleil of Nov. 25, 1983)

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TABLE 4: Agricultural Productivity in the DIOURBEL Region:
Production, Yields and Areas of Major Crops 1961 - 1984

Year	PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall	
	Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Index 2/ mm's	
1961	147.2	1,005	146.5	30.2			-		-	-		-	1.00	210	4.77	-		-	739	137
62	146.0	1,014	144.0	59.4	666	89.2	-		-	-		-	1.37	245	5.59	-		-	566	105
63	121.5	874	139.0	54.4	414	131.4	-		-	-		-	0.58	135	4.30	-		-	621	115
64	143.9	834	172.5	69.5	523	132.8	-		-	-		-	0.93	245	3.80	-		-	579	107
65	125.6	860	146.0	73.9	574	135.0	-		-	-		-	0.88	259	3.40	-		-	726	134
66	132.2	1,017	130.0	72.5	487	149.0	-		-	-		-	1.40	205	6.84	-		-	563	104
67	34.2	238	144.0	22.8	154	148.0	-		-	-		-	0.28	144	1.95	-		-	605	112
68	144.4	929	155.5	84.8	577	147.0	-		-	-		-	4.69	182	25.70	-		-	858	159
69	76.7	522	146.8	38.4	299	128.3	-		-	-		-	1.74	222	7.85	-		-	340	63
70	67.0	536	125.0	56.3	511	110.1	-		-	-		-	1.31	194	6.77	-		-	571	106
71	44.0	311	141.5	27.2	269	101.0	-		-	-		-	1.32	252	5.23	-		-	386	71
72	110.0	851	129.3	59.1	597	99.0	-		-	-		-	2.08	283	7.35	-		-	564	104
73	51.5	338	152.3	43.8	423	103.5	-		-	-		-	2.57	286	8.98	-		-	410	76
74	67.3	530	126.9	58.5	400	146.2	-		-	-		-	2.12	339	6.25	-		-	307	57
75	116.3	851	136.6	103.6	639	162.2	-		-	-		-	0.87	337	2.58	-		-	538	99
76	220.0	1,194	184.2	88.7	529	167.8	-		-	-		-	3.56	445	8.00	-		-	453	84
77	175.0	978	179.0	100.6	623	161.5	-		-	-		-	2.81	400	7.03	-		-	443	82
78	87.8	492	178.5	37.8	253	149.2	-		-	-		-	1.27	310	4.10	-		-	302	56
79	152.2	870	174.9	128.0	794	161.2	-		-	-		-	0.75	560	1.34	-		-	571	106
80	96.5	713	135.4	95.6	555	172.4	-		-	-		-	5.61	614	9.13	-		-	478	88
81	41.6	306	136.0	52.9	363	145.6	-		-	-		-	0.97	189	5.13	-		-	349	65
82	115.3	931	123.8	96.9	555	174.5	-		-	-		-	6.99	552	12.66	-		-	409	76
83	107.0	697	153.6	58.4	447	130.7	-		-	-		-	2.02	275	7.35	-		-	388	72
84	41.0	121	144.3	31.8	294	108.2			-		-	-	3.9	709	5.56		-	-	•	

Sources: Same as for Table 2

Note: 1/, 2/, 3/: See Table 2

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TABLE 5: Agricultural Productivity in the FLEUVE Region:
Production, Yields and Areas of Major Crops 1961 - 1984

r	PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall	
	Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Index 2/	mm's
1	5.1	785	6.5	38.6	498	77.5	15.7	2,379	6.6	3.3	767	4.3	2.24	302	7.42	–		0.13	379	119
2	3.6	387	9.3	51.5	472	109.0	18.3	2,440	7.5	4.3	782	5.5	3.50	334	10.49			0.15	371	116
3	3.5	321	10.9	54.9	482	113.8	18.9	2,363	8.0	2.4	490	4.9	3.41	291	11.71	–		–	264	83
4	5.9	364	16.2	39.2	354	110.6	22.7	2,735	8.3	1.5	366	4.1	2.95	315	9.36	–		–	382	120
5	6.3	412	15.3	65.2	522	125.0	21.1	2,221	9.5	8.1	559	14.5	5.83	328	17.76	–		0.10	369	116
6	15.9	589	27.0	52.7	432	122.0	27.5	2,132	12.9	7.8	488	16.0	2.30	192	12.00	–		–	438	137
7	7.9	712	11.1	52.9	430	123.1	38.1	2,458	15.5	8.4	579	14.5	6.08	328	18.51	–		–	417	131
8	6.8	553	12.3	72.6	518	140.1	28.1	1,713	16.4	9.1	467	19.5	15.10	557	27.09	–		–	342	107
9	21.5	1,792	12.0	37.8	354	106.7	15.5	975	15.9	3.7	529	7.0	4.02	223	18.04	–		–	276	87
0	5.1	500	10.2	63.8	612	104.2	31.0	1,962	15.8	7.0	686	10.2	8.39	436	19.23	–		–	426	134
1	0.98	1,000	9.8	29.0	318	91.1	23.0	1,456	15.8	5.3	631	8.4	5.32	624	8.52	–		–	243	76
2	2.0	167	12.0	49.4	417	118.4	27.9	2,385	11.7	6.6	653	10.1	9.77	460	21.23	–		–	283	89
3	–	0	4.5	1.1	22	49.5	6.5	565	11.5	0.2	500	0.4	0.17	213	0.80	–		–	118	37
4	0.6	90	6.7	27.4	317	86.5	9.8	1,225	8.0	2.7	587	4.6	1.92	202	9.50	–		–	197	62
5	1.4	237	5.9	53.2	441	120.6	17.2	1,830	9.4	5.7	740	7.7	3.42	267	12.81	–		–	229	72
6	5.1	750	6.8	41.1	434	94.6	13.0	1,238	10.5	0	0	5.7	4.49	305	14.71	–		–	302	95
7	0.96	160	6.0	23.1	231	99.9	23.3	2,178	10.7	0	0	3.0	4.12	270	15.25	–		–	260	82
8	1.3	224	5.8	8.6	113	76.1	17.3	2,218	7.8	1.2	480	2.5	1.89	134	14.11	–		–	159	50
9	4.0	571	7.0	37.6	410	91.6	27.4	2,884	9.5	4.1	732	5.6	3.60	282	12.82	–		–	281	88
0	0.5	200	2.5	12.0	312	38.5	30.8	3,143	9.8	3.5	1,250	2.8	1.22	213	5.73	–		–	227	71
1	1.8	474	3.8	27.9	323	86.4	31.6	3,258	9.7	4.7	797	5.9	2.50	270	9.26	–		–	237	74
2	3.0	769	3.9	26.7	474	56.3	36.9	3,583	10.3	4.5	682	6.6	2.92	313	9.32	–		–	230	72
3	3.0	361	8.3	4.3	140	30.8	46.1	3,365	13.7	3.3	375	8.8	0.68	100	6.83	–		–	198	62
4	–		1.1	6.9	283	24.4	68.6	4,635	14.8	1.6	421	3.8	0.03	–	4.04					

Sources: Same as for table 2

Note: 1/, 2/, 3/: See table 2

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TABLE 6: Agricultural Productivity in the LOUGA Region
Production, Yields and Areas of Major Crops 1961 - 1984

PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall Index 2/ mm's	
Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area		
84.6	800	105.8	25.2	231	109.3	-		-	-		-	1.50	158	9.50	-		-	523	132
112.0	1,087	103.0	26.3	231	113.8	-		-	-		-	4.13	252	16.41	-		-	448	113
69.5	724	96.0	22.0	246	89.6	-		-	-		-	2.63	282	9.33	-		-	346	87
101.0	748	135.1	50.6	332	152.2	-		-	-		-	4.60	243	18.95	-		-	451	113
94.4	787	120.0	51.0	340	150.0	-		-	-		-	4.18	250	16.70	-		-	495	124
132.3	865	153.0	51.8	332	156.0	-		-	-		-	4.32	254	17.00	-		-	449	113
78.8	483	163.3	31.0	281	110.3	-		-	-		-	5.98	218	27.40	-		-	371	93
132.9	911	145.9	73.5	480	153.0	-		-	-		-	3.47	137	25.30	-		-	667	168
97.9	509	192.2	39.3	308	127.5	-		-	-		-	5.75	283	20.35	-		-	237	60
111.0	804	138.0	41.7	337	123.9	-		-	-		-	6.50	287	22.65	-		-	372	94
40.5	248	163.6	27.1	210	129.2	-		-	-		-	6.13	230	26.65	-		-	285	72
130.4	918	142.0	49.6	462	107.3	-		-	-		-	7.12	367	19.40	-		-	296	74
14.6	94	155.7	8.3	60	138.5	-		-	-		-	5.65	116	48.50	-		-	205	52
63.3	505	125.3	43.2	240	179.9	-		-	-		-	6.50	290	22.38	-		-	272	68
118.5	742	159.6	82.2	526	156.4	-		-	-		-	10.11	438	23.08	-		-	341	86
191.7	1,009	190.0	74.0	498	148.7	-		-	-		-	10.09	497	20.30	-		-	267	67
108.5	600	180.9	39.8	301	132.4	-		-	-		-	4.13	205	20.12	-		-	284	71
48.0	273	175.6	27.6	203	135.7	-		-	-		-	4.68	218	21.43	-		-	250	63
172.8	958	180.4	88.6	550	161.0	-		-	-		-	12.30	428	28.75	-		-	331	83
84.1	420	200.2	47.0	330	142.5	-		-	-		-	7.55	352	21.43	-		-	247	62
127.0	717	177.2	66.2	427	155.1	-		-	-		-	10.54	370	28.52	-		-	327	82
159.8	850	187.9	52.8	284	185.9	-		-	-		-	12.11	400	30.29	-		-	355	89
159.0	782	203.4	50.7	288	176.3	-		-	-		-	6.67	233	28.63	-		-	324	81
22.4	509	39.4	8.4	385	21.0							4.48	369	12.15					

Sources: Same as for table 2

Note: 1/, 2/, 3/: See table 2

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TABLE 7: Agricultural Productivity in the Region of SENEGAL ORIENTAL
Production, Yields and Areas of Major Crops 1961 - 1984

ar /	PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall Index 2/ mm's	
	Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area		
61	31.0	1,000	31.0	34.6	672	51.5	1.3	813	1.6	9.2	860	10.7	0.50	217	2.30	-		-	602	73
62	37.2	1,057	35.2	34.2	656	52.1	1.4	875	1.6	9.2	860	10.7	0.78	312	2.50	-		-	789	96
63	41.0	1,073	38.2	35.1	659	53.3	1.2	750	1.6	10.6	883	12.0	0.80	300	2.67	-		-	862	105
64	43.4	1,000	43.4	37.9	714	53.1	1.3	867	1.5	11.1	902	12.3	0.75	300	2.50	-		-	943	115
65	41.1	1,242	33.1	41.8	703	59.5	1.4	933	1.5	10.9	872	12.5	0.27	290	0.93	0.36	632	0.57	1024	125
66	36.3	1,052	34.5	46.6	696	67.0	1.5	882	1.7	12.1	890	13.6	0.33	300	1.10	0.52	642	0.81	939	114
67	33.3	949	35.1	50.0	698	71.6	1.4	737	1.9	13.2	795	16.6	0.37	308	1.20	0.79	637	1.24	1235	150
68	35.9	992	36.2	53.5	729	73.4	1.9	826	2.3	14.7	850	17.3	0.31	298	1.04	3.27	1,486	2.20	964	117
69	28.9	898	32.2	45.0	625	72.0	2.6	867	3.0	4.4	647	6.8	0.37	253	1.46	7.14	1,556	4.59	792	96
70	25.0	862	29.0	69.0	785	87.9	1.8	1,059	1.7	13.1	879	14.9	0.30	297	1.01	7.45	1,110	6.71	745	91
71	17.0	384	44.3	30.6	382	80.1	1.4	737	1.9	8.9	536	16.6	0.49	383	1.28	5.62	712	7.89	690	84
72	30.4	740	41.1	54.9	754	72.8	4.2	977	4.3	14.2	768	18.5	0.57	383	1.49	10.10	1,200	8.42	1225	149
73	28.0	642	43.6	40.1	545	73.6	3.5	875	4.0	9.9	544	18.2	-			11.07	1,053	10.51	622	76
74	22.2	464	46.8	32.5	454	71.6	6.0	1,200	5.0	16.2	818	19.8	-		-	12.79	1,054	12.13	723	88
75	42.9	1,044	41.1	38.2	611	62.5	12.5	1,623	7.7	19.0	779	24.4	-		-	17.41	1,071	16.25	957	117
76	58.0	985	58.9	60.0	861	69.7	18.4	1,769	10.4	23.4	863	27.1	-		-	15.08	877	17.20	783	95
77	60.3	1,189	50.7	18.3	308	59.5	12.7	1,155	11.0	7.2	456	15.8	-		-	18.97	960	19.77	970	118
78	33.2	787	42.2	34.2	584	58.6	11.4	919	12.4	10.6	475	22.3	-		-	11.09	576	19.24	932	114
79	65.6	1,023	64.1	52.4	869	60.3	9.8	1,114	8.8	16.5	922	17.9	-		-	11.90	672	17.71	575	70
80	36.7	601	61.1	29.6	446	66.4	8.5	842	10.1	16.3	682	23.9	-		-	9.31	799	11.65	691	84
81	26.8	469	57.1	36.1	641	56.3	5.6	800	7.0	13.0	568	22.9	-		-	6.23	610	10.21	609	74
82	56.0	923	60.7	50.6	845	59.9	6.4	3,368	1.9	12.0	2,308	5.2	-		-	12.49	1,126	11.09	777	95
83	54.1	914	59.2	55.8	849	65.7	4.0	952	4.2	26.8	1,076	24.9				10.50	905	11.60	643	78
84	32.0	522	61.5	23.5	389	61.7	4.1	719	5.4	16.2	610	25.7				7.50	682	11.00		

Sources: Same as for table 2

Note: 1/, 2/, 3/: See table 2

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TABLE 8: Agricultural Productivity in the SINE-SALOUM Region
Production, Yields and Areas of Major Crops 1961 - 1984

r	PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rainfall Index 2/ mm's	
	Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area		
1	408.2	950	429.7	156.6	641	244.4	2.1	300	7.0	1.8	783	2.3	3.60	300	12.00	–	–	–	601	85
2	425.0	902	471.0	127.2	479	265.5	3.8	345	11.0	1.8	857	2.1	3.00	300	12.00	–	–	0.01	664	94
3	416.9	864	482.5	141.7	525	270.1	2.8	452	6.2	1.9	864	2.2	3.00	300	12.00	–	–	0.02	592	84
4	400.3	843	475.1	157.1	539	291.5	3.8	551	6.9	2.0	833	2.4	2.31	330	7.00	–	–	0.02	644	91
5	498.0	1,005	495.7	172.8	579	298.5	4.9	662	7.4	1.9	792	2.4	2.28	327	6.97	0.01	333	0.03	876	124
6	528.0	1,058	499.0	184.1	584	315.0	4.6	708	6.5	1.7	810	2.1	1.82	345	5.28	0.02	500	0.04	655	93
7	488.7	949	514.7	148.5	481	308.5	3.0	667	4.5	0.3	375	0.8	2.19	–	–	0.04	500	0.08	780	110
8	403.8	760	531.5	187.8	533	352.5	2.8	778	3.6	0.9	750	1.2	2.14	302	7.09	0.23	821	0.28	907	128
9	377.5	723	522.2	155.6	448	347.3	–	–	3.5	0.6	667	0.9	2.09	302	6.92	0.79	859	0.92	441	62
0	372.5	957	389.3	204.2	631	323.7	1.1	846	1.3	0.6	857	0.7	1.57	253	6.20	1.37	1,038	1.32	654	92
1	291.8	670	435.7	133.5	465	287.0	0.2	182	1.1	0.4	667	0.6	0.51	79	6.47	1.90	734	2.59	482	68
2	410.1	911	450.4	197.6	618	319.7	2.4	889	2.7	0.6	857	0.7	1.98	303	6.53	3.37	824	4.09	771	109
3	342.8	754	454.9	140.7	440	320.0	0.2	71	2.8	0.4	500	0.8	0.07	–	6.21	2.39	784	3.05	415	59
4	297.5	648	458.9	160.4	468	343.1	0.2	95	2.1	1.0	1,429	0.7	–	–	–	3.16	704	4.49	464	66
5	434.4	1,010	430.0	332.2	787	422.0	4.3	1,000	4.3	2.0	1,667	1.2	–	–	–	6.14	1,027	5.98	564	60
6	618.3	1,150	537.7	179.1	683	262.3	1.4	824	1.7	5.6	1,931	2.9	–	–	–	4.72	838	5.63	694	98
7	586.0	977	599.7	200.0	710	281.8	1.6	889	1.8	16.3	1,264	12.9	–	–	–	5.26	880	5.98	540	76
8	218.7	419	522.3	165.8	498	333.0	0.2	167	1.2	10.0	781	12.8	0.02	182	0.11	2.54	329	7.72	415	59
9	378.9	784	483.0	296.6	809	366.8	0.8	667	1.2	14.4	1,426	10.1	0.07	219	0.32	4.85	606	8.00	941	133
30	259.5	683	380.1	192.4	585	328.9	0.5	500	1.0	2.9	191	15.2	0.23	489	0.47	4.96	799	6.21	571	81
31	235.2	509	462.3	236.1	575	410.8	0.7	412	1.7	20.0	800	25.0	–	–	–	3.15	635	4.96	436	62
32	356.2	835	426.6	314.1	712	441.0	–	–	–	27.3	1,909	14.3	1.39	406	3.42	5.33	1,066	5.00	665	94
33	512.3	1,110	461.4	220.2	651	338.7	–	–	–	29.3	1,085	27.0	–	–	–	–	–	–	584	82
34	222.3	503	451.6	169.1	413.	349.8				7.4	823	13.9	0.70	299	2.34	1.80	346	2.69	•	

Sources: Same as for table 2

Note: 1/, 2/, 3/: See table 2

TABLE 9: Agricultural Productivity in the THIES Region
Production, Yields and Areas of Major Crops 1961 - 1984

Year 1/	PEANUT			MILLET/SORGHUM			RICE (Paddy)			CORN			NIEBE			COTTON			Rain Index mm's
	Production	Yield 3/	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	
1961	130.1	1,000	130.1	44.4	351	126.5	-		-	-		-	2.26	253	8.94			-	640
62	148.0	1,121	132.0	45.4	355	128.0	-		-	-		-	2.33	254	9.16	-		-	635
63	119.3	896	133.2	46.7	368	127.0	-		-	-		-	2.31	254	9.11	-		-	969
64	130.7	1,035	126.3	51.4	389	132.1	-		-	-		-	2.59	274	9.44	-		-	556
65	122.0	891	137.0	43.1	310	139.0	-		-	-		-	3.28	322	10.20	-		-	727
66	142.6	977	146.0	52.7	359	147.0	-		-	-		-	3.25	310	10.50	-		-	544
67	85.4	705	121.1	41.9	287	145.9	-		-	-		-	2.89	239	12.10	-		-	530
68	158.2	1,006	157.3	68.3	419	163.1	-		-	-		-	4.06	356	11.40	-		-	828
69	112.8	666	169.3	45.1	285	158.1	-		-	-		-	2.79	232	12.04	-		-	330
70	114.5	758	151.0	77.6	471	164.9	-		-	-		-	3.26	257	12.70	-		-	624
71	72.4	531	136.3	33.4	219	152.4	-		-	-		-	3.04	242	12.54	-		-	684
72	169.2	1,088	155.5	81.0	506	160.1	-		-	-		-	3.74	281	13.29	-		-	327
73	18.8	118	158.8	13.2	85	155.9	-		-	-		-	1.97	95	20.80	-		-	202
74	92.3	611	151.0	103.4	589	175.6	-		-	-		-	4.16	310	13.40	-		-	476
75	151.0	975	154.8	83.5	676	123.5	-		-	0.45	634	0.71	6.88	433	15.89	-		-	555
76	191.3	977	195.8	98.1	763	128.5	-		-	0.54	701	0.77	5.48	361	15.19	-		-	668
77	119.9	747	160.5	49.4	406	121.6	-		-			-	4.70	235	20.00	-		-	415
78	33.0	244	135.0	21.5	211	102.0	-		-	-		-	3.45	213	16.20	-		-	290
79	137.3	1,297	105.9	117.7	1,070	110.0	-		-	-		-	4.00	250	16.00	-		-	580
80	105.7	656	161.1	62.4	548	113.8	-		-	-			3.43	220	15.60	-		-	412
81	51.4	342	150.3	66.1	422	156.8	-		-	-		-	2.28	251	9.09	-		-	394
82	81.3	693	117.3	115.7	722	160.3	-		-	-		-	4.38	410	10.67	-		-	503
83	143.0	990	144.5	104.4	687	151.9	-		-				1.75	400	4.38				413
84	77.8	526	148.0	44.8	334	134.4							3.46	226	15.29				

Sources: Same as for table 2

Note: 1/, 2/, 3/: See table 2

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TABLE 1⑤

PRIMARY SECTOR'S CONTRIBUTION TO GDP 1976 to 1984

(in billions of CFAF)

	1976		1977		1978		1979		1980		1981		1982		1983*		1984*	
	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP	Value	% of Total GDP
Agriculture	82.0	18.0	74.1	18.4	43.3	9.2	78.4	13.5	59.4	9.5	54.1	8.0	115.9	13.3	119.1	12.2	74.0	7.0
Livestock	28.7	6.3	32.3	8.0	31.4	6.3	36.7	6.3	37.5	6.0	41.5	6.2	45.7	5.4	54.2	5.5	64.2	6.0
Fishing	18.4	4.0	18.1	4.4	18.1	3.6	13.1	2.3	12.7	2.0	15.9	2.4	18.0	2.1	20.0	2.1	24.0	2.3
Forestry	7.9	1.7	8.0	2.0	9.8	2.0	10.6	1.8	10.4	1.6	9.6	1.4	10.1	1.2	10.6	1.1	11.1	1.0
Primary Sector	138.0	30.2	132.5	32.8	104.6	21.1	138.8	23.8	120.0	19.1	121.1	18.0	189.7	22.0	204.7	20.9	174.1	16.3
GDP	459.3	100.0	403.6	100.0	494.7	100.0	581.8	100.0	627.4	100.0	669.8	100.0	844.1	100.0	977.4	100.0	1065.7	100.0

* Estimates

Source: RAPID (1982), Population Survey, Washington: The Futures Group, 1982.

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TABLE ~~1.12~~

SENEGAL: SELECTED EXPORTS, 1977 - 1982[1]

(Volume in metric tons)

	1977	1978	1979	1980	1981	1982[2]
Peanut products	661,217	219,133	401,195	175,379	56,793	351,184
unroasted peanuts	81,633	5,459	10,247	2,728	2,904	4,659
unprocessed oil	192,334	52,736	120,565	62,580	21,594	151,485
refined oil	34,996	12,807	15,069	11,203	432	163
peanut meal	352,254	148,131	255,314	98,868	31,863	194,877
Non-peanut Products	2,642,611	2,478,920	2,458,482	2,384,777	2,074,257	2,061,828
of which:						
fresh fish	37,562	32,843	36,886	49,295	46,016	44,982
shellfish	6,849	6,880	6,721	6,531	6,236	6,369
processed fish	16,816	13,223	11,695	11,557	15,176	15,413
fresh vegetables	12,853	7,698	4,466	11,985	7,173	10,121
flour	6,086	21,007	8,390	3	203	431
gum arabic	746	562	2,359	484	252	500
leather and skins	741	958	1,256	1,114	1,350	1,118
cotton in bulk	12,588	10,505	9,345	5,827	4,190	10,121
TOTAL	3,303,828	2,698,053	2,859,677	2,560,156	2,131,050	2,413,012

(Value in millions of CFAF)

	1977	1978	1979	1980	1981	1982[2]
Peanut products	75,509	23,539	42,254	17,571	9,145	41,918
unroasted peanuts	10,411	795	1,970	465	884	642
unprocessed oil	40,206	13,033	27,046	11,324	6,236	31,125
refined oil	8,295	3,425	3,772	1,585	126	51
peanut meal	16,597	6,286	12,466	4,197	1,899	10,100
Non-peanut Products	77,411	71,720	71,604	83,196	126,731	138,119
of which:						
fresh fish	4,614	5,690	6,288	7,157	10,093	10,496
shellfish	4,035	5,351	6,079	6,437	6,828	7,457
processed fish	7,807	6,622	6,352	7,310	10,642	11,695
fresh vegetables	1,244	743	722	871	893	1,098
flour	460	1,598	1	-	21	59
gum arabic	195	139	124	126	76	178
leather and skins	402	514	732	616	729	649
cotton in bulk	4,876	3,415	2,943	2,168	1,991	4,770
TOTAL	152,920	95,259	113,858	100,767	135,876	180,037
Memorandum Item CFAF/$1	235.3	209.0	201.0	225.8	272.0	328.6

Sources: 1977-1980: Ministère de l'Economie et des Finances, Direction de la Statistique, Analyse du Commerce Extérieur du Sénégal en 1979 et 1980, tableau no. 3, p. 15.
1981-1982: Direction de la Statistique, Division du Commerce Extérieur.

[1] Some figures do not agree with those of Table 1.11.

[2] Figures for 1982 are provisional.

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SENEGAL

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TABLE [illegible]

BALANCE OF PAYMENTS 1977 - 1984

(In Billions of CFAF)

	1977	1978	1979	1980	1981	1982	198	
Exports	.163.9	90.8	116.4	103.7	139.0	168.8	195.4	
Peanut products	75.3	23.5	41.7	19.9	9.2	44.3	59.	
-unrefined oil	(40.2)	(13.0)	(25.5)	(11.9)	(6.0)	(33.9)	(38.	
-refined oil	(8.3)	(3.4)	(3.3)	(1.8)	(0.3)	(0.2)	(1.	
-meal	(16.6)	(6.3)	(10.2)	(5.9)	(2.8)	(9.5)	(14.	
-groundnuts	(10.4)	(0.8)	(2.5)	(0.3)	(0.1)	(0.7)	(4.7)	(-
Cotton	4.9	3.4	3.5	2.2	2.0	5.0	9.7	
Fish	16.4	17.6	21.3	21.2	37.5	48.0	47.8	
Non-agricultural products	67.1	46.3	49.9	60.4	90.3	71.5	78.5	
Imports	189.8	168.0	181.3	205.5	274.7	282.1	314.2	
Rice	11.3	12.6	14.8	18.1	27.1	26.3	32.0	
Wheat	4.6	2.9	5.4	4.5	4.8	5.3	8.2	
Sugar	5.5	3.7	3.8	5.4	3.8	1.8	3.1	
Other food products	13.1	14.3	16.5	12.8	17.3	21.8	31.6	
Non-agricultural products	155.3	134.5	140.8	164.7	221.7	226.9	239.3	
AGRICULTURAL TRADE BALANCE								
including fish	62.3	10.0	26.0	2.5	-4.3	42.1	42.0	38.
excluding fish	45.9	-7.6	8.4	-18.8	-41.8	-5.9	-5.8	-16
TRADE BALANCE	-25.9	-77.2	-64.9	-101.8	-135.7	-113.3	-118.8	[illegible]
NET SERVICES BALANCE	-17.2	-3.0	-16.8	-26.8	-36.3	-26.2	-52.4	[illegible]
NET UNREQUITED TRANSFERS	26.3	27.2	22.4	36.2	41.7	46.7	50.2	[illegible]
CURRENT ACCOUNT BALANCE	-16.8	-53.0	-59.3	-92.4	-130.3	-94.8	-121.0	-8
CAPITAL ACCOUNT BALANCE	13.7	43.1	55.3	62.8	70.9	51.1	80.5	62.
ERRORS AND OMISSIONS	0.3	-8.2	5.0	6.5	7.3	5.5	5.6	[illegible]
OVERALL BALANCE	-2.8	-18.1	1.0	-23.1	-52.1	-38.2	-34.9	-23.6
OVERALL BALANCE AS PERCENTAGE OF GDP	1.0	3.7	-	3.7	7.8	4.5	3.6	3.2

* Estimates

Source: Ministère de l'Economie et des Finances

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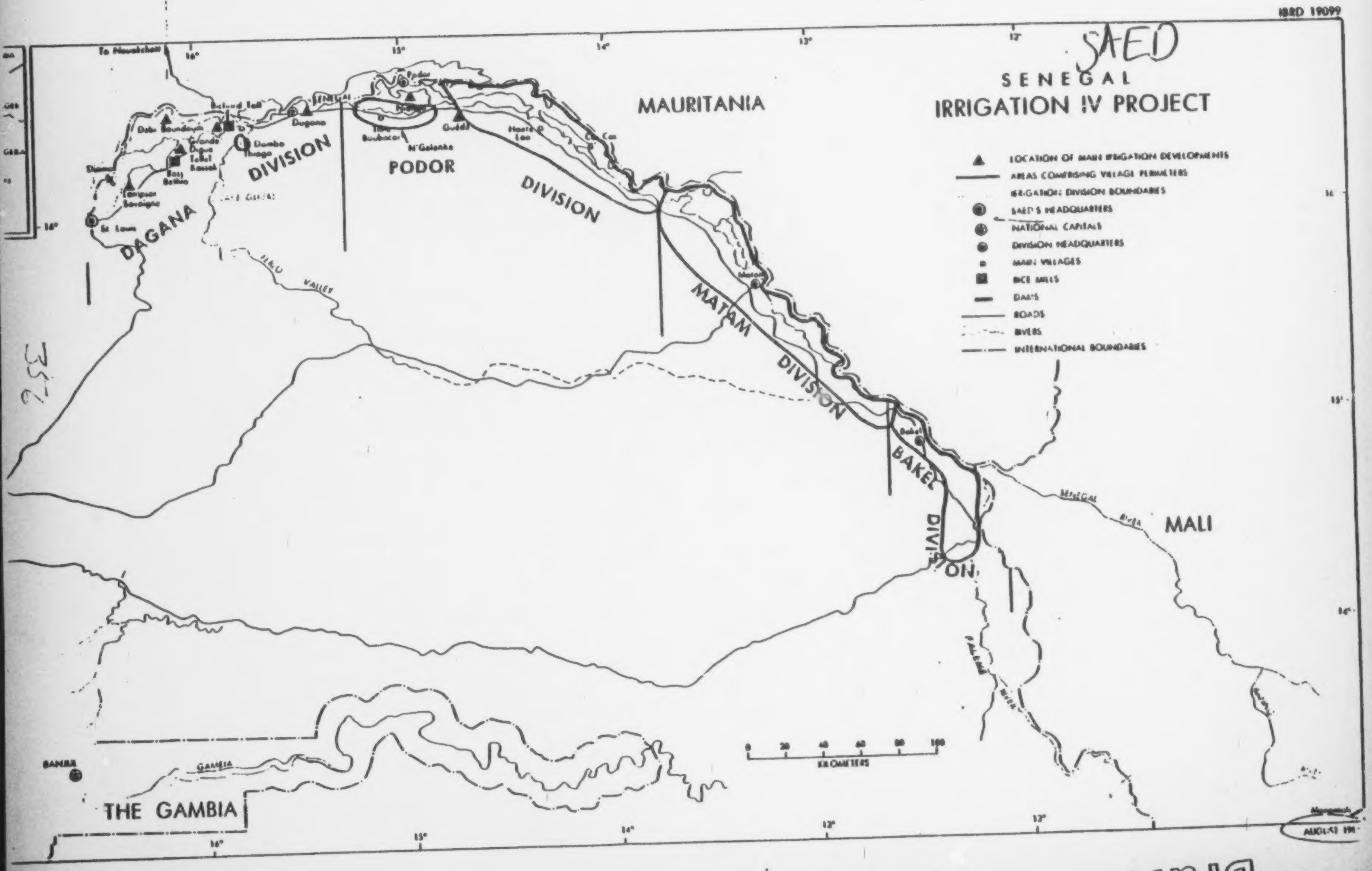
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SENEGAL
IRRIGATION IV PROJECT
LOCATION OF MAIN IRRIGATION DEVELOPMENTS
AREAS COMPRISING VILLAGE PERIMETERS
IRRIGATION DIVISION BOUNDARIES
SAED'S HEADQUARTERS
NATIONAL CAPITALS
DIVISION HEADQUARTERS
MAIN VILLAGES
RICE MILLS
DAMS
ROADS
RIVERS
INTERNATIONAL BOUNDARIES
MAURITANIA
MALI
THE GAMBIA
DAGANA DIVISION
PODOR DIVISION
MATAM DIVISION
BAKEL DIVISION
To Nouakchott
St. Louis
Dagana
Richard Toll
Podor
Guédé
Matam
Bakel
N'Galenka
Dombo Thiago
Boss Bellina
Grande Digue Tellel
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TABLE

Production/Area under irrigation schemes

. PRODUCTION AND AREA UNDER IRRIGATION SCHEMES — SENEGAL

~~Tableau 7~~

EVOLUTION DES PRODUCTIONS ET DES RENDEMENTS 1/
(HIVERNAGE ET CONTRE-SAISON)

cf Rice [illegible]

PERIMETRES SAED Rice Senegal R. Delta

Année	Riz			Maïs/sorgho			Tomate			Maraîchage divers		
	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)
1977-78	3 400	13 400	3,9	126	220	1,75	800	15 600	19,5	-	-	-
1978-79	7 600	27 000	3,5	668	1 470	2,2	896	11 000	12,2	-	-	-
1979-80	7 950	33 500	4,2	1 058	3 640	3,44	758	18 150	23,9	-	-	-
1980-81	7 940	32 800	4,1	952	2 350	2,47	645	13 100	20,3	-	-	-
1981-82	8 700	38 600	4,4	1 200	2 760	2,3	773	13 470	17,4	-	-	-
1982-83	12 437	54 342	4,3	1 955	3 030	1,55	1 179	24 940	21,1	48,2	-	-
1983-84 (prévision)	15 053,8	74 475	4,9	2 000	4 000	2,0	1 000	20 000	20	76	-	-

PERIMETRES SONADER

Année	Riz			Maïs/sorgho			Tomate			Maraîchage divers		
	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)
1977-78	208	835	4,0	-	-	-	-	-	-	-	-	-
1978-79	385	1 885	4,9	78,4	196	2,5	-	-	-	-	-	-
1979-80	631	2 400	3,8	88,5	310	3,5	-	-	-	-	-	-
1980-81	1 232	4 720	3,8	736	1 990	2,7	-	-	-	-	-	-
1981-82	980	4 125	4,2	794	2 700	3,4	-	-	-	-	-	-
1982-83	1 690	7 250	4,3	443	1 150	2,6	-	-	-	141,5 (niébé)	42,4	0,3
1983-84 (hivernage uniquement)	1 655	8 500	5,1	80	160	2,0	-	-	-	-	-	-

PERIMETRES DU HAUT-BASSIN - (OVSTH)

Année	Riz			Maïs/sorgho			Tomate			Maraîchage divers		
	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)	Superf. récoltée (ha)	Product. (t)	Rendement (t/ha)
1977-78	24,5	49	2,0	69,2	76,1	1,1	11	132	12	22,11	-	-
1978-79	9,9	24,7	2,5	95	285	3	15	210	14	19,3	-	-
1979-80	0,12	0,3	2,5	99,6	129,5	1,3	20	280	14	35,1	-	-
1980-81	1,9	4,7	2,5	76,2	91,4	1,2	22	275	12,5	31,4	-	-
1981-82	2	4,4	2,2	97	134,4	1,4	14	210	15	19,2	-	-
1982-83	8,1	16,2	2,0	101,4	121,7	1,2	16	240	15	25,2	-	-

1/ Source: Enquêtes socio-économiques.

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Contract Paper No. 9

DRAFT

The Role of Low-Resource Agriculture in Africa: Sudan Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW RESOURCE AFRICAN AGRICULTURE

SUDAN supplementary Information

1. Production statistics

a. In addition to crop production data provided in the overview, production data for sorghum, millet, wheat, sesame, groundnuts and cotton by province are shown in Tables 1-6. These data are from the Annual Situation and Outlook report of the Ministry of Agriculture , Khartoum, Sudan. Figure 1 is a political map of Sudan which shows the location of different provinces referred to in Tables 1-6.

b. Agriculture provides 40 percent of GDP, 90 percent of export earnings and 60 percent of the country's employment.

c. The contribution of major crops and livestock to export earnings is found in Figure 2.

2. Producers

Data from a UNDP survey of all 11 provinces in Northern Sudan are used to provide information on characteristics of agricultural producers. This survey was conducted in 1981 and was published by the Ministry of Finance and Economic Planning in 1983, titled, "RURAL LABOR STUDY IN NORTHERN SUDAN". This however excludes the 6 provinces of Southern Sudan.

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a. Population Distribution

Table 7 shows the population distribution of agrarian households by sex, residence (i.e. if they live in or out of the household) and province.

b. Estimated Income Levels

The estimated income levels of these agrarian households are shown in Table 8, and a comparison of per capita incomes of agricultural and non-agricultural households is shown in Table 9.

c. Distribution of income by sex

The national survey did not make an attempt to discern the distribution of household income by sex. Micro level studies (which are few) make an attempt to get at a distribution of labor use by sex, but not necessarily income by sex. However, we have found 1 survey of a limited area in Western Sudan which reports distribution of agricultural income by sex and size distribution of land farmed by sex. Data from this survey are shown in Table 10-13. A review of farm level studies in the irrigated subsector did not provide similar data. However, a survey of cotton pickers in the Gezira scheme done in 1981 by the University of Gezira shows that 40 %of cotton pickers are migrants, and that 80 percent of cotton pickers are women (these include children). Wages paid for cotton picking include transportation, housing, food and a cash wage.

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d. Distribution of Households by Farm Size

The distribution of agrarian households by farm size is shown in Table 14, with their distribution by farm size according to type of agriculture is shown in Table 15. (Here, modern agriculture would cover areas which we have defined as non-LRA. i.e. irrigated and mechanized rainfed subsectors).

In trying to delineate all of the above data by agroecological zone and crop, we can only attempt to relate our knowledge of the location of crop production to generate rough estimates.

i. As the above data covers the northern regions of Sudan, it is limited to the ASA zone (according to an definition), However in Sudan, the ASA zone covers over 90 percent of production of major crops.

ii. Irrigated agriculture (i.e. non-LRA) is predominant in Blue Nile, Gezira, White Nile Northern and Nile provinces. Mechanized rainfed (also non-LRA) is predominant in Kasala and South Kerdofan, but also found in Blue Nile. Hence, in the Northern provinces, North Kordofan, North Darfour, South Darfour and parts of the other provinces could be classified as LRA.

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2. Livestock

Livestock production i.e. cattle, sheep, goats and camels are predominantly (over 90 %) under low-resource conditions found in Western, Southern and Central part of the country, with 40 % of the national herd being found in Western Sudan.

Data an estimates of national livestock production are shown in Table 16. Livestock is raised by sedentary herders, transhumants and nomads although it is difficult to estimate the distribution of ownership among these groups. LRA livestock is a major source of livestock exports for the country. As seen earlier the share of livestock in foreign exchange earnings has been increasing, due to both increased livestock exports and decreased exports from other crops.

3. Method of Production

a. irrigated/rainfed

The distribution of crops by methods of production and LRA vs. non - LRA is shown in Table 17 for cotton, groundnuts, sesame, sorghum, and wheat.

b. Types and amounts of fertilizers, pesticides and other commercial inputs.

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- all fertilizers and pesticides which are imported inputs are used in the irrigated subsector
- Machinery ,also an imported input is used in the irrigated and mechanized rainfed subsectors.

Table 18 shows levels of these inputs utilized for 1982.

c. Labor: Has been discussed earlier.

d. role of animals in mixed farms, pastoral system. Animals are important for all three types of livestock producers, although animal traction is still not yet well accepted.

e. Monocropping/intercropping

Crop grown in the irrigated and mechanized subsectors are monocropped.

Crop mixtures are found in the traditional subsector. In W. Sudan, some common inter crops are millet/sesame and sorghum/groundnuts. The extent of intercropping varies by soil type, latitude, and rainfall during the season. Further details on the influence of specific exogenous and endogenous factors on production decisions can be found in "Production Decisions of Traditional Farmers in W. Sudan: A Resource Based Analysis" unpublished M.Sc. thesis University of Khartoum, 1985.

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4. Consumption of the Product

a. Cotton- 70-80% of production is exported

b. Sorghum - 5% of production is exported

c. Sesame - 30% of production is expected

4. Groundnuts - 30-40% of production is exported

5. Millet - 100% is consumed locally

6. Wheat is consumed locally and over 50% of consumption is imported.

(Note: due to drought, the above are ranges for the 80/81 - 83/84 period). By products of cotton, sesame, and groundnuts such as cake and oil are used locally as well as exported.

5. Processing and Storage of the Product

Most crops are stored using traditional methods, varying from very large underground pits (in the mechanized Subsector) to small family owned granaries in W. Sudan. The Government own and operates modern storage facilities with a capacity of 250,000 tons. New storage facilities were contracted to handle last year's drought induced food imports. Processing facilities exist for cotton giving and oilseed mills, both in the irrigated subsector and Western Sudan, as well as in urban areas.

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Production Center ( ) = Region	5-Year Average 1/ Area 000 Fed	 Prod 000 MT	 Yield Kg/Fed	Crop Season-1984/85 Area 000 Fed	 Prod 000 MT	 Yield Kg/Fed	Crop Season 1985/86 Area 000 Fed	 Prod 000 MT	Prel. Yield Kg/Fed	Record Yield Kg/Fed
IRRIGATED										
Nile Province (N)	18	9	500	15	8	500	40	20	500	615
Northern Province (N)	9	4	444	10	8	750	25	15	600	750
Blue Nile (C) 2/	55	22	400	40	16	400	55	33	600	500
Gezira & Managil (C)	331	143	432	420	264	630	579	400	690	630
Rahad (C) 2/	25	15	600	70	49	700	90	68	750	778
Suki (C)	15	6	400	21	9	450	36	23	630	N/A
White Nile (C)	40	15	375	30	12	400	60	27	450	485
Gash (E) 2/	30	8	267	65	26	400	65	35	540	436
New Halfa (E) 2/	40	16	400	60	30	500	140	63	450	500
Tokar (E)	19	6	316	35	14	400	40	16	400	674
Total Irrigated	582	250	430	766	436	569	1130	699	618	—
RAINFED MECHANIZED										
Damazin (C) 2/	941	278	295	1171	116	99	2570	810	315	453
Kosti (C)	225	59	262	237	21	90	610	146	240	639
Gedarif (E) 2/	2546	735	289	2502	195	78	3016	995	330	400
Dilling (W) 2/	333	88	264	250	23	92	346	95	275	445
Rank (S)	342	107	313	374	34	90	786	283	360	541
South Darfur (W)	11	3	273	--	--	--	7	2	300	400
Total Rainfed Mech.	4398	1267	288	4534	389	86	7335	2331	318	366 —
RAINFED TRADITIONAL										
Blue Nile (C)	602	162	269	450	55	122	*	0	*	350
Gezira (C)	154	38	247	70	4	57	1300	351	270	400
White Nile (C)	149	28	188	160	10	63	*	0	*	371
North Kordofan (W)	436	58	133	303	8	25	173	19	110	300
South Kordofan (W)	370	89	241	609	54	89	796	159	200	397
North Darfur (W)	48	5	104	45	1	22	114	21	180	380
South Darfur (W)	362	84	232	300	40	134	420	101	240	427
Southern Region (S)	762	137	180	750	100	133	900	162	180	520
Total Rainfed Trad.	2883	601	208	2687	272	101	3703	813	219	—
TOTAL ALL	7863	2118	269	7987	1097	137	12168	3843	316	—

1/ 5-year average includes 1979-80 to 1983-84. 2/ 1985/86 season estimates revised. * Combined with Gezira.
TOTALS MAY NOT ADD DUE TO ROUNDING.

SUDAN: SOURCE: MIN OF AGRICULTURE, 1986

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Table 2: MILLET : AREA, PRODUCTION, AND YIELD, 1985/86 CROP SEASON WITH COMPARISIONS

Production Center ( ) = Region	5-Year Average 1/			Crop Season-1984/85			Crop Season-1985/86 Prel.		
	Area 000 Fed	Prod 000 MT	Yield Kg Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg Fed
IRRIGATED									
Tokar (E) Flood	14	5	357	20	10	500	22	9	400
	--	-	---	--	--	---	--	-	---
Total Irrigated	14	5	357	20	10	500	22	9	400
RAINFED MECHANIZED									
Damazin (C)	0	0	0	0	0	0	20	7	360
Gedarif (E)	5	1	200	11	1	91	11	3	270
	-	-	---	--	-	—	--	--	---
Total Rainfed Mech.	5	1	200	11	1	91	31	10	326
RAINFED TRADITIONAL									
Blue Nile (C)	64	10	156	50	4	80	*	0	
Gezira (C)	6	1	167	61	1	16	75	14	180
White Nile (C)	77	14	182	60	4	67	*	0	
North Kordofan (W)	1045	103	99	1534	20	13	2013	201	100
South Kordofan (W)	41	8	195	50	4	80	105	21	200
North Darfur (W) 2/	410	56	137	360	13	36	730	91	125
South Darfur (W)	984	180	183	900	90	100	850	119	140
Southern Region (S)	84	14	167	80	11	138	85	14	167
	----	---	---	---	---	---	----	---	---
Total Rainfed Trad.	2711	386	142	3095	147	47	3858	460	119
	====	===	===	====	===	==	====	===	===
TOTAL ALL	2730	392	144	3126	158	51	3911	479	123

1/ 5-year average includes 1979-80 to 1983-84. 2/ 1985-86 season estimates revised. * Combined with Gezira.

TOTALS MAY NOT ADD DUE TO ROUNDING.

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Table 3: WHEAT : AREA, PRODUCTION, AND YIELD, 1985/86 CROP SEASON WITH COMPARISIONS

Production Center ( ) = Region	5-Year Average 1/			Crop Season-1984/85			Crop Season -1985/86 Prel.		
	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed
IRRIGATED									
Nile Province (N)	7	4	571	5	3	600	10	6	600
Northern Province (N)	20	16	800	45	31	700	50	40	800
Gezira & Managil (C) 2/	264	137	482	--	--	--	240	120	500
White Nile (C) 2/	6	2	333	65	45	600	30	15	500
New Halfa (E)	45	20	444	--	--	--	30	14	450
	---	---	---	---	--	---	---	---	---
Total Irrigated	360	180	500	115	79	687	360	195	542
	===	===	===	===	==	===	===	===	===
TOTAL ALL	360	180	500	115	79	687	360	195	542

1/ 5-year average includes 1979-80 to 1983-84 crop years. 2/ 1985-86 season estimate revised.

TOTALS MAY NOT ADD DUE TO ROUNDING.

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Table 4: SESAME : AREA, PRODUCTION, AND YIELD, 1985/86 CROP SEASON WITH COMPARISIONS

Production Center	5-Year Average 1/			Crop Season-1984/85			Crop Season-1985/86 Prel.		
( ) = Region	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed
RAINFED MECHANIZED									
Damazin (C)	202	2[illegible]	109	200	26	130	735	66	90
Gedarif (E)	311	42	138	343	39	114	430	39	90
Dilling (W)	22	3	136	30	1	33	27	2	90
Rank (S)	36	4	111	30	4	133	21	3	135
	---	---	---	---	---	---	---	---	---
Total Rainfed Mech.	571	72	126	603	70	116	1213	110	91
RAINFED TRADITIONAL									
Blue Nile (C)	246	31	126	75	7	93	250	23	90
White Nile (C)	34	4	118	15	1	67	*	0	*
North Kordofan (W)	723	52	72	634	6	10	685	31	45
South Kordofan (W)	114	15	132	171	7	41	192	25	130
North Darfur (W) 2/	11	1	91	10	1	100	50	4	75
South Darfur (W)	178	14	79	180	21	117	50	4	80
Southern Region (S)	163	22	135	165	20	121	150	18	120
	---	---	---	---	---	---	---	---	---
Total Rainfed Trad.	1469	139	95	1250	63	50	1377	104	76
	===	===	===	===	===	===	====	====	===
TOTAL ALL	2040	211	103	1853	133	72	2590	214	83

1/ 5-year average includes 1979-80 to 1983-84. 2/ 1985-86 season estimate revised. * Combined with Blue Nile.

TOTALS MAY NOT ADD DUE TO ROUNDING.

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Table 5: GROUNDNUTS : AREA, PRODUCTION, AND YIELD, 1985/86 CROP SEASON WITH COMPARISIONS

Production Center ( ) = Region	5-Year Average 1/			Crop Season-1984/85			Crop Season -1985/86		Prel.
	Area 000 Fed	Prod 000 MT	Yield Kg Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed	Area 000 Fed	Prod 000 MT	Yield Kg/Fed
IRRIGATED									
Gezira & Managil (C)	181	140	773	213	170	798	103	77	750
Blue Nile (C)	1	1	1000	2	1	500	--	0	---
Rahad (C)	63	50	794	65	56	892	40	32	800
Suki (C)	16	16	1000	12	8	667	1	1	600
New Halfa (E)	38	34	895	34	20	588	2	1	650
	---	--	---	---	---	---	---	---	---
Total Irrigated	299	241	809	326	257	788	146	111	761
RAINFED TRADITIONAL									
Blue Nile (C)	20	9	450	8	2	250	20	7	350
White Nile (C)	49	15	306	15	3	200	*	0	*
North Kordofan (W)	673	161	239	381	11	29	146	44	300
South Kordofan (W)	34	8	235	18	1	55	28	9	325
North Darfur (W) 2/	90	17	189	60	2	33	60	18	300
South Darfur (W)	704	160	227	700	70	100	463	106	230
Southern Region (S)	242	52	215	250	40	160	180	32	180
	----	---	---	----	---	---	----	---	---
Total Rainfed Trad.	1812	422	233	1432	129	90	897	217	242
	====	===	===	====	===	===	====	===	===
TOTAL ALL	2111	663	314	1758	386	220	1043	328	314

1/ 5-year average includes 1979-80 to 1983-84. 2/ 1985-86 crop estimate revised * Combined with Blue Nile.

TOTALS MAY NOT ADD DUE TO ROUNDING.

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Table 6: COTTON : AREA, PRODUCTION, AND YIELD, 1985/86 CROP SEASON WITH COMPARISIONS

Production Center ( ) = Region	5-Year Average 1/			Crop Season-1984/85			Crop Season -1985/86		
	Area 000 Fed	Prod 000 MT	Yield Big Kantars	Area 000 Fed	Prod 000 MT	Yield Big Kantars	Area 000 Fed	Prod 000 MT	Prel. Yield Big Kantars
EGYPTIAN									
Gezira & Managil (C)	395	[illegible]	3.31	357	240	4.75	411	4/	
Blue Nile (C)	4[illegible]	[illegible]	2.04	3/			--		
White Nile (C) 2/	67	23	2.43	32	20	4.50	53	5/	
Gash (E)	--	--	--	--	--	--	--		
Topaz (E) 2/	17	3	1.25	10	1	0.76	30		
Total, Egyptian	524	224	3.02	399	261	4.62	494		
ACALA									
Zeidab (N)	5	2	2.83	--	--	--	--		
Gezira & Managil (C)	98	70	5.05	123	113	6.50	--		
Blue Nile (C) 2/	14	8	4.04	65	40	4.35	55		
Rahad (C)	109	89	5.77	131	130	7.00	118		
Suki (C) 2/	27	13	3.40	25	12	3.50	32		
White Nile (C)	12	5	2.94	33	16	3.50	--		
New Halfa (E) 2/	68	31	3.22	91	52	4.00	69		
Total, Acala	333	218	4.63	468	363	5.48	274		
AMERICAN									
Blue Nile (C)	33	6	1.28	7	2	1.50	7		
Gedarif (E)	9	1	0.79	2	1	1.20	2		
Nuba Mountains (W)	64	7	0.77	90	19	1.50	36		
Equatoria (S)	24	2	0.59	30	2	0.47	25		
Total, American	130	16	0.87	129	24	1.30	70		
TOTAL, ALL	985	458	3.29	996	648	4.60	838		

1/ 5-year average includes 1979-80 to 1983-84 crop years. 2/ 1985-86 season estimate revised .
3/ Area and production now credited to Acala. 4/ 24,000 feddans in Shambat variety.
5/ About 50% of area [illegible] in Shambat variety.

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Figure 1 : SUDAN

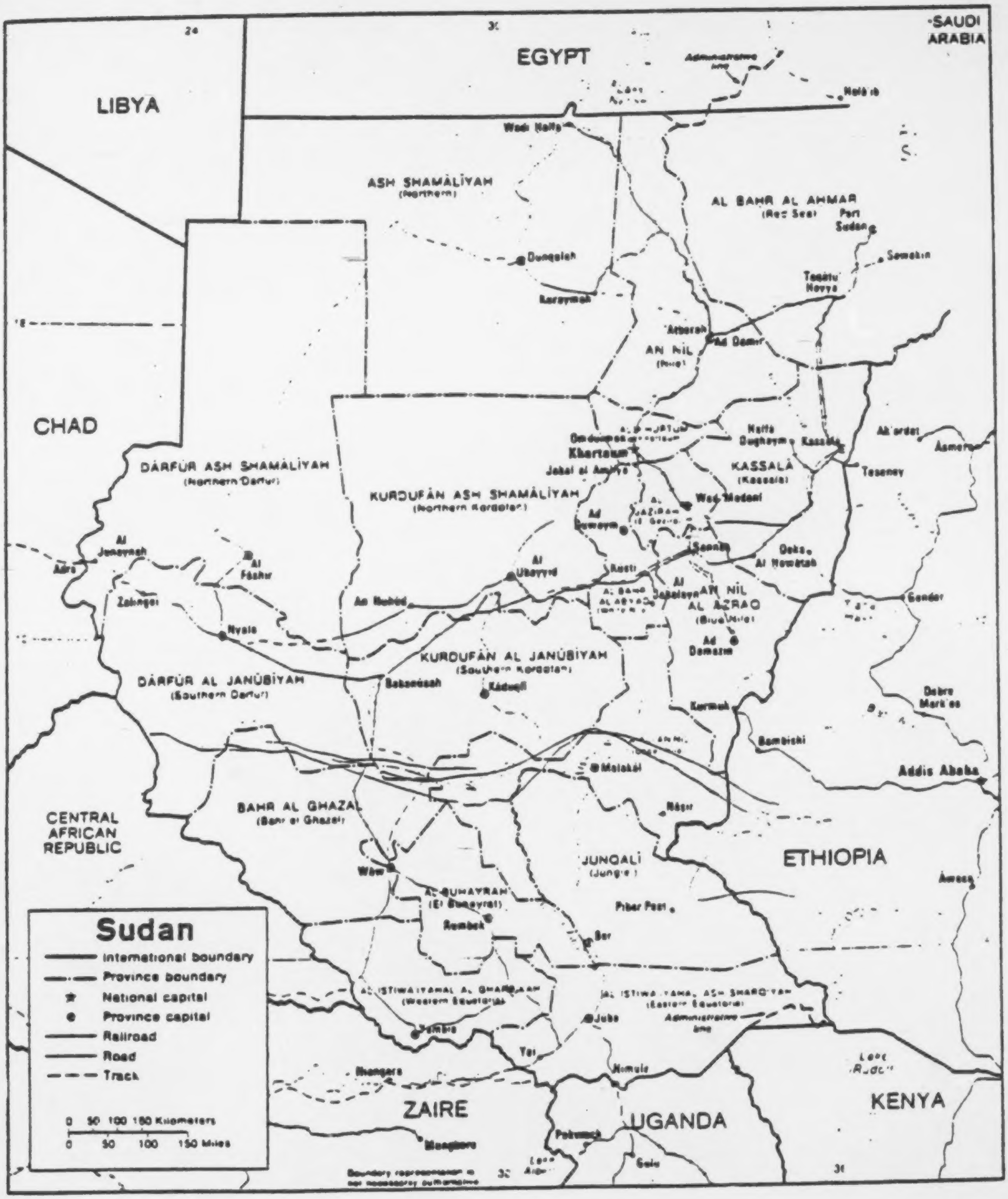
SAUDI ARABIA
EGYPT
LIBYA
CHAD
CENTRAL AFRICAN REPUBLIC
ZAIRE
UGANDA
KENYA
ETHIOPIA
Administrative line
Halaib
Wadi Halfa
ASH SHAMALIYAH (Northern)
AL BAHR AL AHMAR (Red Sea)
Port Sudan
Sawakin
Tokar
Dunqulah
Karaymah
Atbarah
Ad Damir
AN NIL (Nile)
Omdurman
Khartoum
Jabal al Awliya
Halfa Dughaym
Kassala
KASSALA (Kassala)
Tesenay
Ak'ordat
Asmera
Wad Medani
AL JAZIRAH (El Gezira)
Ad Duwaym
Sennar
Gedaref
Al Hawatah
Kosti
Al Ubayyid
AN NIL AL AZRAQ (Blue Nile)
Ad Damazin
Gonder
DARFUR ASH SHAMALIYAH (Northern Darfur)
KURDUFAN ASH SHAMALIYAH (Northern Kordofan)
Al Junaynah
Adre
Al Fashir
Zalingei
Nyala
An Nuhud
KURDUFAN AL JANUBIYAH (Southern Kordofan)
Kaduqli
Babanusah
DARFUR AL JANUBIYAH (Southern Darfur)
Kurmuk
Dembi Dolo
Debre Mark'os
Addis Ababa
Malakal
Nasir
BAHR AL GHAZAL (Bahr el Ghazal)
Waw
JUNQALI (Jungle)
Pibor Post
AL BUHAYRAH (El Buhayrat)
Rumbek
Bor
AL ISTIWA'IYAH AL GHARBIYAH (Western Equatoria)
AL ISTIWA'IYAH ASH SHARQIYAH (Eastern Equatoria)
Yambio
Juba
Yei
Nimule
Nzara
Lake Rudolf
Awasa
Pakwach
Gulu
Isiro
Lake Albert
Sudan
International boundary
Province boundary
National capital
Province capital
Railroad
Road
Track
0 50 100 150 Kilometers
0 50 100 150 Miles
Boundary representation is not necessarily authoritative

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Figure 2: SUDAN

Foreign Exchange Earnings

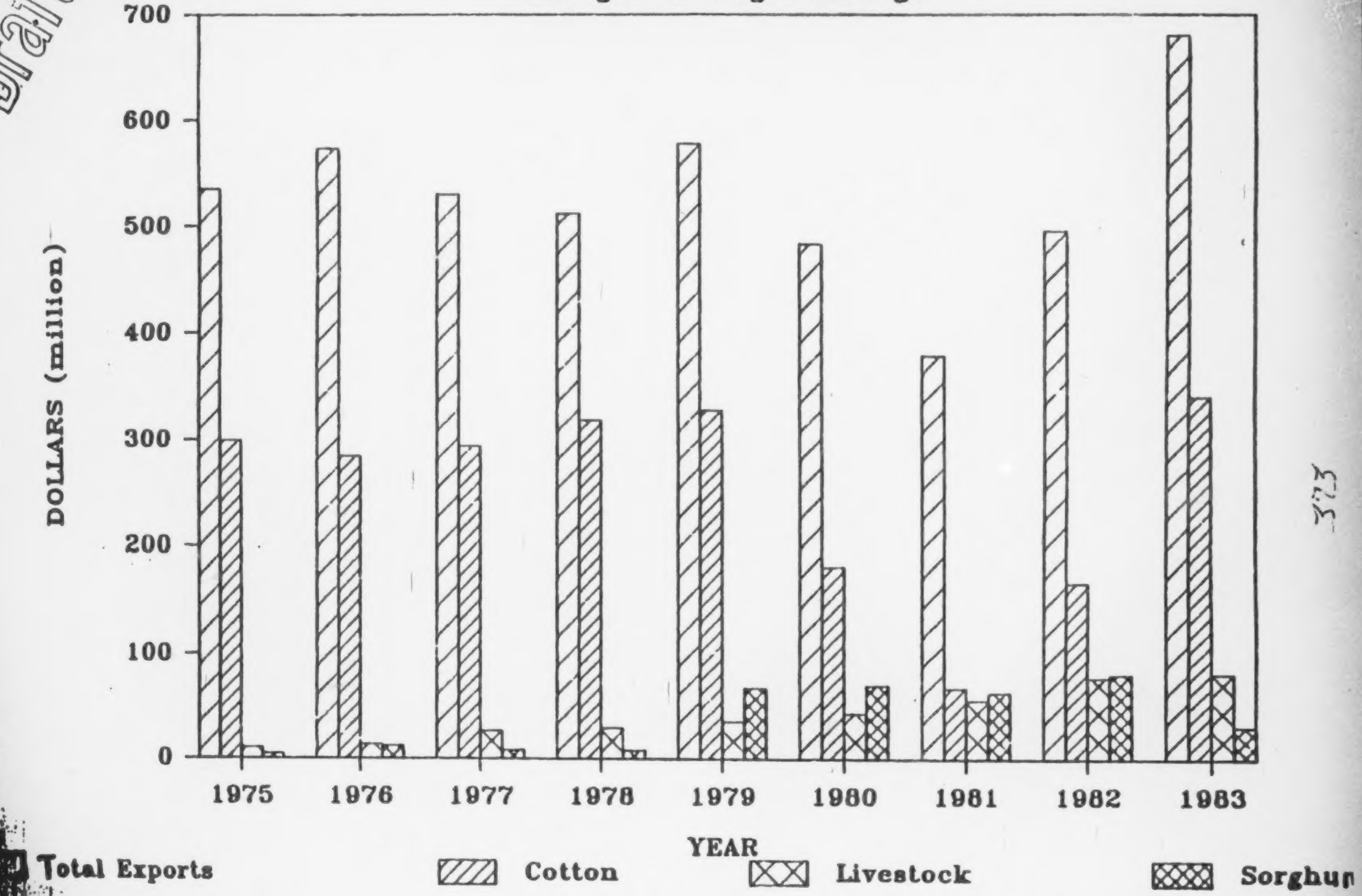

TABLE NO. (7)

Draft

FAMILY STRUCTURE

POPULATION OF AGRARIAN HOUSEHOLDS

BY SEX, RESIDENCE & PROVINCE

		BLUE NILE 2	GEZIRA 3	WHITE NILE 4	NORTH-KORDFAN 5	SOUTH-KORDFAN 6	NORTH-DARFOUR 7	SOUTH-DARFOUR 8	KASSALA 9	RED SEA 10	NORTHERN 11	NILE 12	TOTAL
1 NUMBER OF FAMILIES		73602 6.41	217683 18.95	134160 11.68	164177 14.29	108028 9.40	118470 10.31	157986 13.75	95170 8.28	0 0.00	36593 3.19	42964 3.74	1148833 100.00
2 L.T. 6 YEARS	MALES	55432 7.04	131516 16.71	111220 14.13	92466 11.75	76221 9.68	99636 12.66	117300 14.90	56252 7.15	0 0.00	20958 2.66	26236 3.33	787237 100.00
3	FEMALES	72822 8.81	130560 15.80	94920 11.49	120375 14.57	72825 8.81	96968 11.73	102570 12.41	81468 9.86	0 0.00	16643 2.01	37240 4.51	826391 100.00
4	TOTAL	128254 7.95	262076 16.24	206140 12.77	212841 13.19	149046 9.24	196604 12.18	219870 13.63	137720 8.53	0 0.00	37601 2.33	63476 3.93	1613628 100.00
5 RESIDENT	MALES	208208 7.02	590744 19.91	375160 12.65	366128 12.34	241837 8.15	324178 10.93	407422 13.73	240306 8.11	0 0.00	85828 2.89	126495 4.26	2966306 100.00
6 ..	FEMALES	173124 5.51	631040 20.09	369510 11.77	427572 13.61	293242 9.34	326554 10.40	419748 13.37	260172 8.28	0 0.00	102795 3.27	136857 4.36	3140614 100.00
7 ..	TOTAL	381332 6.24	1221784 20.01	744670 12.19	793700 13.00	535079 8.76	650732 10.66	827170 13.54	500678 8.20	0 0.00	188623 3.09	263352 4.31	6107120 100.00
8 NON-RESIDENT	MALES	6760 1.90	81920 23.00	43160 12.12	58842 16.52	45160 12.68	33212 9.32	14076 3.95	37864 10.63	0 0.00	23932 6.72	11244 3.16	356226 100.00
9 ..	FEMALES	1374 1.50	8704 9.52	20340 22.25	11556 12.64	16507 18.06	9269 10.14	8679 9.50	9198 10.06	0 0.00	3916 4.28	1862 2.04	91405 100.00
10 ..	TOTAL	8134 1.82	90632 20.25	63500 14.19	70398 15.73	61675 13.78	42401 9.49	22755 5.08	47082 10.52	0 0.00	27868 6.23	13106 2.93	447631 100.00
11 TOTAL	MALES	270400 6.58	804180 19.57	519540 12.68	517436 12.59	363226 8.84	457026 11.12	538798 13.11	334642 8.14	0 0.00	130730 3.18	163975 3.99	4109969 100.00
12 ..	FEMALES	247320 6.09	770304 18.98	484770 11.94	559503 13.79	382574 9.43	432791 10.66	530997 13.08	350838 8.64	0 0.00	123354 3.04	175959 4.34	4058410 100.00
13 ..	INDIVIDUALS	517720 6.34	1574492 19.20	1014310 12.42	1076939 13.18	745800 9.13	889817 10.89	1069795 13.10	685480 8.39	0 0.00	254092 3.11	339934 4.16	8168379 100.00

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'ABLE NO. (8

ESTIMATED INCOME LEVELS OF AGHARIAN HOUSEHOLDS BY PROVINCE

		BLUE NILE	GEZIRA	WHITE NILE	NORTH-KORDFAN	SOUTH-KORDFAN	NORTH-DARFOUR	SOUTH-DARFOUR	KASSALA	RED SEA	NORTHERN	NILE'	TOTAL
		2	3	4	5	6	7	8	9	10	11	12	
1	LOW	19082	125628	70434	56940	62140	63184	71526	61400	0	27692	27086	585112
2	MEDIUM	31349	88806	53664	76869	35372	48824	79386	26402	0	5934	12142	458748
3	HIGH	23171	3249	10062	30368	10516	6462	7074	7368	0	2967	3736	104973
TOTAL		73602	217683	134160	164177	108028	118470	157986	95170	0	36593	42964	1148833
	PERCENTAGE DISTRIBUTION												
	1	3.26	21.47	12.04	9.73	10.62	10.80	12.22	10.49	0.00	4.73	4.63	100.00
	2	6.83	19.36	11.70	16.76	7.71	10.64	17.30	5.76	0.00	1.29	2.65	100.00
	3	22.07	3.10	9.59	28.93	10.02	6.16	6.74	7.02	0.00	2.83	3.56	100.00
	TOTAL	6.41	18.95	11.68	14.29	9.40	10.31	13.75	8.28	0.00	3.19	3.74	100.04
	1	25.93	57.71	52.50	34.68	57.52	53.33	45.27	64.52	0.00	75.68	63.04	50.93
	2	42.59	40.80	40.00	46.82	32.74	41.21	50.25	27.74	0.00	16.22	28.26	39.93
	3	31.48	1.49	7.50	18.50	9.73	5.45	4.48	7.74	0.00	8.11	8.70	9.14
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	100.00	100.00	100.00

CELLS (32, 2)

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Table 9

Average per Capita Annual Income of Rural Population by Province

Province	All Households LS	Agri.Households LS	Non.Agri. Households LS
Blue Nile	277	311	245
N.Kordofan	265	268	200
S.Darfur	218	218	N.A.
White Nile	206	210	188
S.Kordofan	200	204	155
N.Darfur	199	204	118
Kassala	185	186	180
Gezira	185	188	170
Nile	181	191	157
Northern	160	165	150
Red Sea	135	N.A.	135
GRAND TOTAL (weighted average)	211	216	189

[redacted]

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Table 10: Percentage distribution of gross income by sex

Income (Ls)	Sex Female	Male
<450	64	13
450-799	20	24
800-1299	13	31
>1300	3	32

Table 11: Percentage distribution of per capita income by sex

Per capita income (Ls)	Sex Female	Male
<90	36	12
90-139	21	30
140-224	28	21
>225	15	27

Table 12: Percentage distribution of land farmed by sex

Size of land (in mukhamas)	Sex Female	Male
<6	64	10
6-9.99	26	26
10-15.99	8	31
>16	2	33

Table 13: Percentage distribution of crops grown by households
% growing crop

Crop	Sex Female	Male
Millet	97	97
Sorghum	41	57
Sesame	79	91
Groundnuts	51	67

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The source of these data is:
"Women farmers in rural settlements in N. Kordofan, Sudan"
By Coughenhour et al. published by The Ahfad Journal, Omdurman, Sudan Dec. 1985. It is based on a survey of 30 female and 167 male producers around El Obeid.

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Table 14

Distribution of Agrarian Households-by size of Total Holdings and Area Cultivated.(per cent)

Size of Holding	Total	Cultivated
Less than 10 feddans	24.5	39.6
10 but less than 20 feddans	24.7	28.9
20 but less than 50 feddans	32.9	26.6
50 but less than 100 feddans	10.8	3.7
100 but less than 500 feddans	7.1	1.5
500 feddan and over	-	0.2
Total	100.0	100.0

TABLE 15

DISTRIBUTION OF AGRICULTURAL HOUSEHOLDS ACCORDING TO THE SIZE OF CULTIVATED LAND & MODE OF AGRICULTURE

(Percent of total households)

Size of Cultivated Holding	Modern Agriculture	Traditional Agriculture
Less than 10 feddans	10.8	28.8
10-20 feddans	9.8	19.1
20-50 feddans	5.9	20.7
50-100 feddans	0.2	3.0
100-500 feddans	0.1	1.4
500 feddans or more	0.2	
TOTAL	27.0	73.0

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Table [illegible]: Livestock production levels (1983/84)

Cattle	12 million
camels	2.5 million
sheep	31 million
goats	13 million

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Table 17. Summary of irrigated vs. rainfed data by zone and LRA classification - Sudan (80/81 - 83/84 avg.)

CROP	**ASA Zone**		**SHT Zone**	
Cotton	AREA (000 fed)	PROD (000 kt)	AREA (000 fed)	PROD (000 kt)
HRA				
Cotton (irrig.)	843	3494	--	--
Cotton (rainfed)	142	728		
Total	985 (= 414,000) (ha)	3622 (510,702) (m. tons)		

no LRA cotton

Crop	**ASA Zone**		**SHT**	
Groundnuts	Area (000 ha)	Prod. (000 m. ton)	Area (000 ha.)	Prod. (000 m. ton)
Irrigated - HRA	114.2	200		
Rainfed - LRA	642	374	105	30
Total	756	574	105	30

CROP	**ASA Zone**		**SHT Zone**	
Sesame	Area (000 ha)	Prod. (000 m. ton)	Area (000 ha)	Prod. (000 m. ton)
Rainfed - HRA	244.7	72		
Rainfed - LRA	550	117	70	20
Total	794.7	189	70	20

Note: There is no irrigated production of sesame.

CROP	**ASA Zone**		**SHT Zone**	
Sorghum	Area (000 ha)	Prod. (000 m. ton)	Area (000 ha)	Prod. (000 m. ton)
Irrigated - HRA	241.7	251	--	--
Mech. Rainfed - HRA	1849	1036	84	50
Rainfed - LRA	950	629	273	81
Total	2090	1288	357	131

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Table 17. (cont.d)

CROP	ASA Zone		SHT Zone	
	Area (000 ha)	Prod. (000 m. ton)	Area (000 ha)	Prod. (000 m. ton)
Wheat				
All HRA	114.5	168	--	--
All irrigated			--	--

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[illegible] Estimated imported input use 1983/84

Chemical fertilizer	150,000 m. tons
Insecticides	20,[illegible] m. tons
Tractors	10,000

Contract Paper No. 10

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The Role of Low-Resource Agriculture in Africa: Zaire Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW-RESOURCE AFRICAN AGRICULTURE

ZAIRE Supplementary Information

1. Production Statistics

a. In addition to data and information provided earlier, the following is provided: Table 1 shows the aggregate production statistics by crop and by agroecological zone for rice, groundnuts, and beans. This is used to illustrate the allocation of regions into agroecological zones. Figure 1 is a map of Zaire showing the location of different agricultural production activities and should be used with Figure 2, which shows the allocation of regions across agroecological zones. Figure 3 is a map showing the location of various development projects which have emphasized specific crops/rural development activities in recent years.

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b. In 1982, agriculture contributed 20 percent of total GDP. Changes in the composition of agricultural production for major crops over the time period 1975-1984 is shown in Table 2. Zairean agriculture is characterized by a traditional small farm subsector and a large-scale plantation subsector. The former contributes nearly 60 percent of total agricultural output with the rest being contributed by the latter. The traditional sector contributes about 3-4 million farming units, occupying 4.5 to 6 million ha. The average farm size is 1.5 ha. In the modern sector, the average size of holding is estimated at 2,300 ha.

c. The volume and value of agricultural exports and non-agricultural exports is seen in Table 3 for the period 1972-1981.

2. Producers

To our knowledge, there are no national surveys of agricultural producers that we could use to make national estimates of items like "the distribution of income by gender" or "an estimate of labor input by crop by gender." We have, however, been able to find micro-studies in specific provinces which detail decision-making by gender.

In a study published in 1982, Louise Fresco studies two UNDP/FAO projects in Kwango-Kwilu subregions of Zaire. Her findings can be summarized as: (1) Women's input in agricultural production averaged 1,562 hours per year; (2) average cultivated area per household was 1.1 ha; (3) cassava was grown in the area in association with maize, millet,

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peanuts, and Bambara nuts. Sales of cassava contributed 43 percent of total income and 85 percent of income from farming. In over 60 percent of the cases, women are responsible for cassava selling, but in 93 percent of these cases, the women give nearly all income to their husbands.

A more detailed in-depth study of decision-making roles in relationship to the adoption of new technology is Terry Hardt's Ph.D. dissertation, "Decision-making roles in the rural household and the adoption and diffusion of an improved maize variety in Northern Shaba Province, Zaire" (Iowa State University, 1981). The sample size in this study was 100 families.

Table 4 shows the division of agricultural labor by activity and gender. Data concerning decision-making within the household, by type of decision and by gender is shown in Table 5. There were no data provided in the dissertation on income levels and their distribution by crop or gender.

3. Method of Production

a. Irrigated/rainfed

Over 95 percent of Zairean agriculture takes place under rainfed conditions. Approximately 3,000 ha of sugarcane is grown under irrigated conditions.

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b. Types and amounts of commercial inputs

Fertilizer is used on maize in selected areas of the country where specific projects or varieties have been introduced (e.g. North Shaba). The overall level of fertilizer use in the country in 1982 was 8,000 tons, of which 100 percent was imported.

c. Intercropping/monocropping

Intercropping is prevalent in all parts of the country, especially in the traditional sector. A complex 14-year crop rotation cycle was observed by Hardt in her field work. This is shown in Table 6.

4. Consumption and Storage

Due to the diversity in microenvironments in a country the size of Zaire, the role of specific crops may vary from one region to another. The complexity of the farming system suggests that producers use a combination of crops to meet their different food needs. The role of different crops in meeting food needs of a rural household is shown by Hardt for North Shaba province in Table 7.

There are to our knowledge no reliable data on storage capacity, either modern or traditional within the country.

TABLE 1.

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--------19[illegible]--

----CLASSIFICATION OF REGIONAL DATA BY AGROECOLOGICAL ZONE----

CROP	REGION	---ZONE---- ---SHT----- ---AREA	----PROD	-----HEL------ ---AREA	----PROD	------HIGHLANDS------- ----AREA	---PROD	-----NATIONAL ----AREA	----PROD
RICE									
	SHABA	10453	8362	0	0			10453	8362
	KIVU	7929	6232	70000	56089			77929	62321
	KASAI-OCC	2800	2249	25205	20163			28005	22403
	KASAI-ORI	3109	2487	27981	22385			31090	24872
	BANDUNDU	3542	2834	14174	11338			17716	14172
	HAUTE-ZAIRE	4514	367	89406	73969			92920	74336
	*			0	0				
	BAS ZAIRE	9072	7260	0	0			9072	7260
	EQUATEUR			47039	37631			47039	37631
				0	0				
				0	0				
	TOTAL	41419	29782	272805	221575			314224	251357

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SHABA	[illegible]	[illegible]	0	0			256391	2074736
KIVU	35621	249349	320592	2244141			356213	2493490
KASAI-OCC	23839	166876	214556	1501887			238395	1668763
KASAI-ORI	19615	137306	176537	1235760			196152	1373066
BANDUNDU	70701	494100	282875	1980931			353576	2475031
HAUTE-ZAIRE	10541	74105	201178	1407926			211719	1482031
*			0	0				
BAS ZAIRE	181444	1270105	0	0			181444	1270105
EQUATEUR			191873	1343110			191873	1343110
			0	0				
			0	0				
TOTAL	638152	4466577	1387611	9713755			2025763	14180332

GROUNDNUTS

REGION	---AREA	----PROD	---AREA	--- PROD	----AREA	---PROD	----AREA	----PROD
SHABA	74892	52424	0	0			74892	52424
KIVU	5103	3572	45934	32153			51037	35725
KASAI-OCC	5547	3882	49923	34947			55470	38829
KASAI-ORI	4296	3007	38665	27065			42961	30072
BANDUNDU	20335	14910	86401	59805			106736	74715
HAUTE-ZAIRE	3610	2507	68433	47923			72043	50430
*			0	0				
BAS ZAIRE	57064	39944	0	0			57064	39944
EQUATEUR			49515	34660			49515	34660
			0	0				
			0	0				
TOTAL	170847	120246	338871	236553			509718	356799

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BEANS

REGION			--AREA		--REA	---PRO	----AREA	PROD
SHABA	19846	9923	0	0			19846	9923
KIVU	4118	2059	37067	18533			41185	20592
KASAI-OCC	2650	1325	23858	11928			26508	13253
KASAI-ORI	2261	1130	20350	10175			22611	11305
BANDUNDU	2950	1476	11813	5905			14763	7381
HAUTE-ZAIRE	1527	760	29054	14530			30581	15290
+			0	0				
BAS ZAIRE	16330	8165	0	0			16330	8165
EQUATEUR			13245	6622			13245	6622
			0	0				
			0	0				
TOTAL	49682	24838	135387	67693			185069	92531

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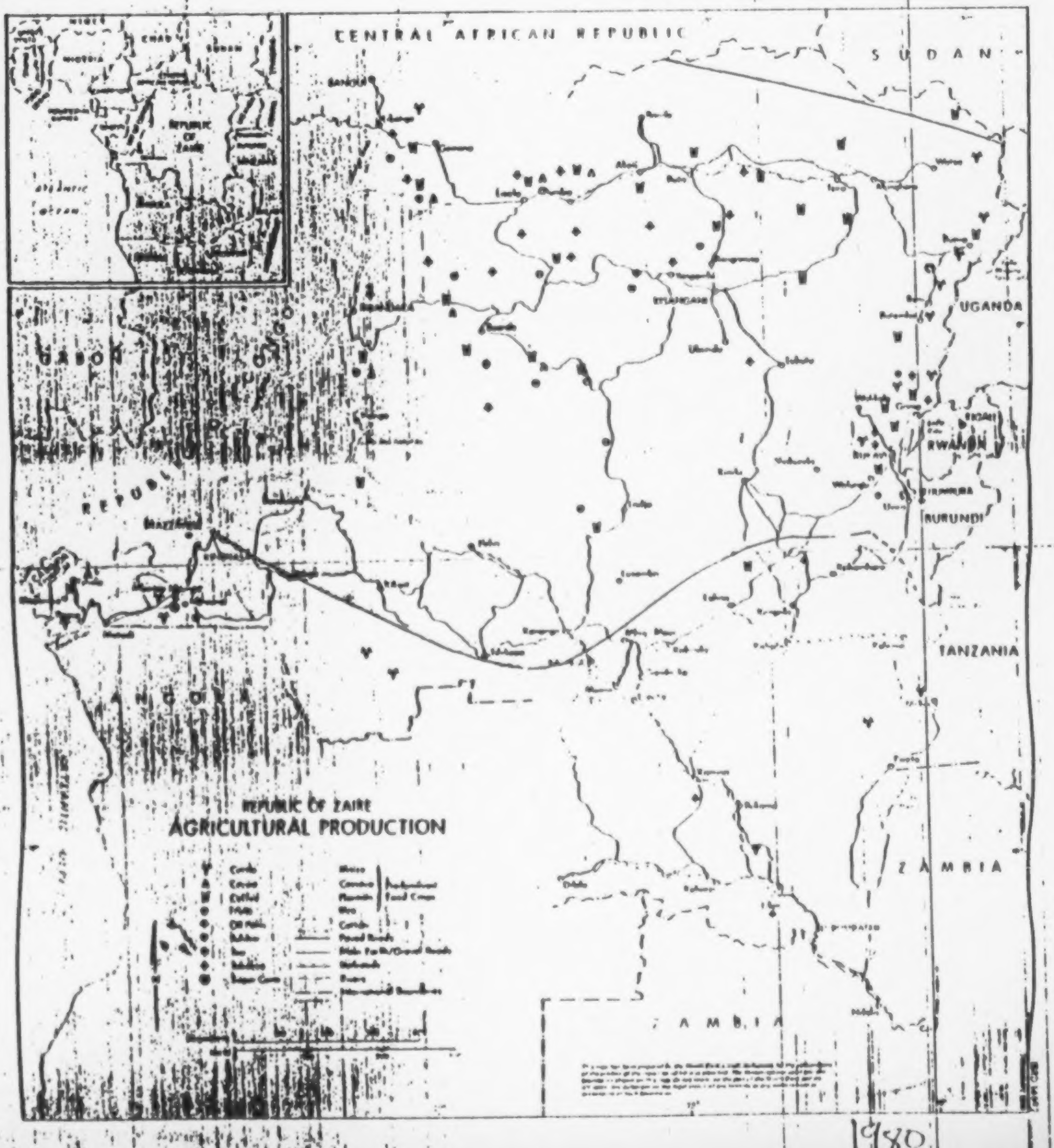
FIGURE [illegible] LOCATION OF AGRICULTURAL PRODUCTION BY CROP, ZAIRE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SUDAN
UGANDA
RWANDA
BURUNDI
TANZANIA
ZAMBIA
ZAMBIA
ANGOLA
GABON
REPUBLIC OF ZAIRE
REPUBLIC OF ZAIRE
AGRICULTURAL PRODUCTION
Cocoa
Coffee
Oil Palm
Sugar Cane
Maize
Cassava
Plantain
Predominant Food Crops
Rice
Cotton
Paved Roads
Railroads
Rivers
International Boundaries

1980

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REGIONS, ZAIRE.

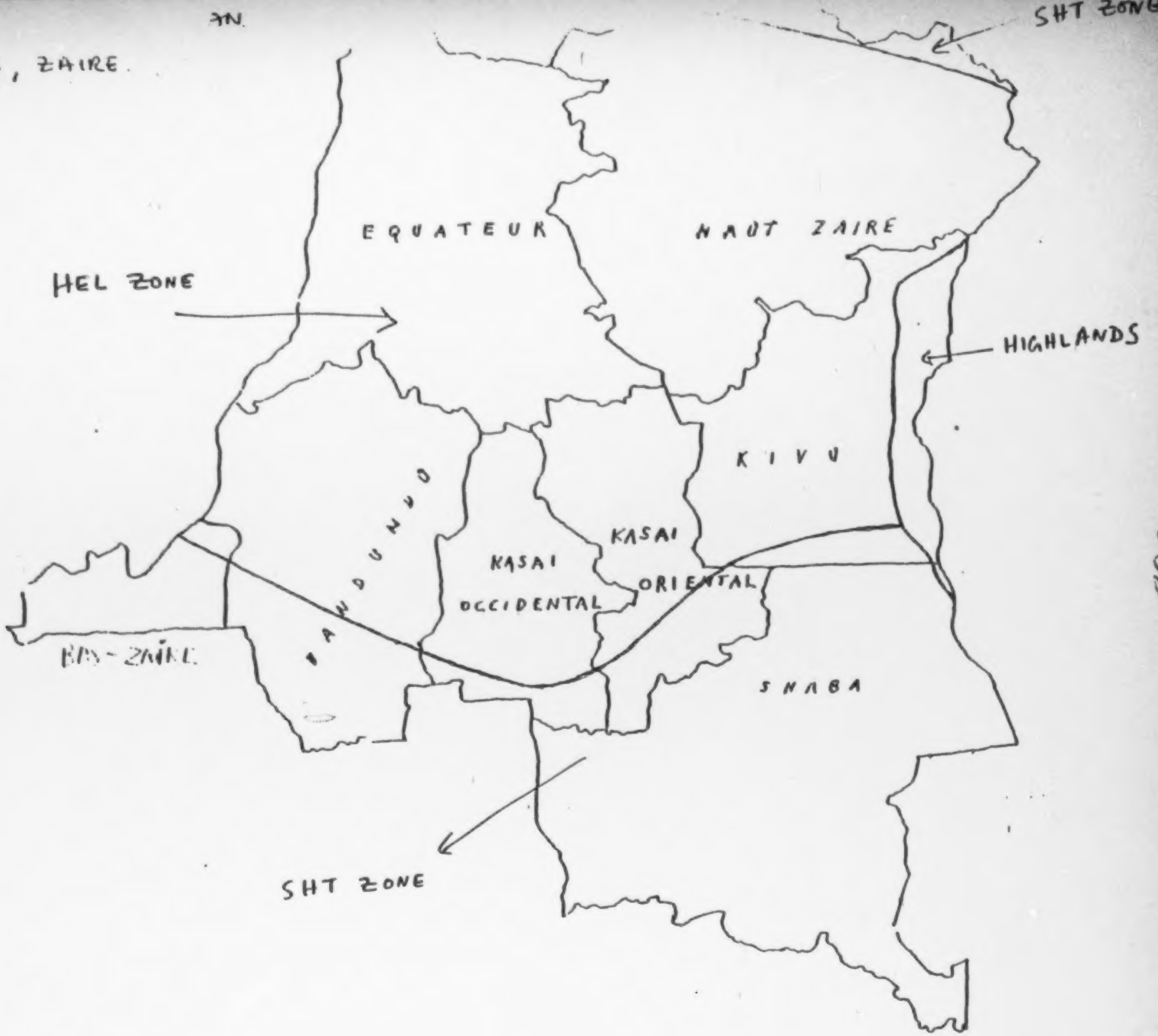
N
SHT ZONE
EQUATEUR
HAUT ZAIRE
HEL ZONE
HIGHLANDS
KIVU
KASAI ORIENTAL
KASAI OCCIDENTAL
BANDUNDU
BAS-ZAIRE
SHABA
SHT ZONE

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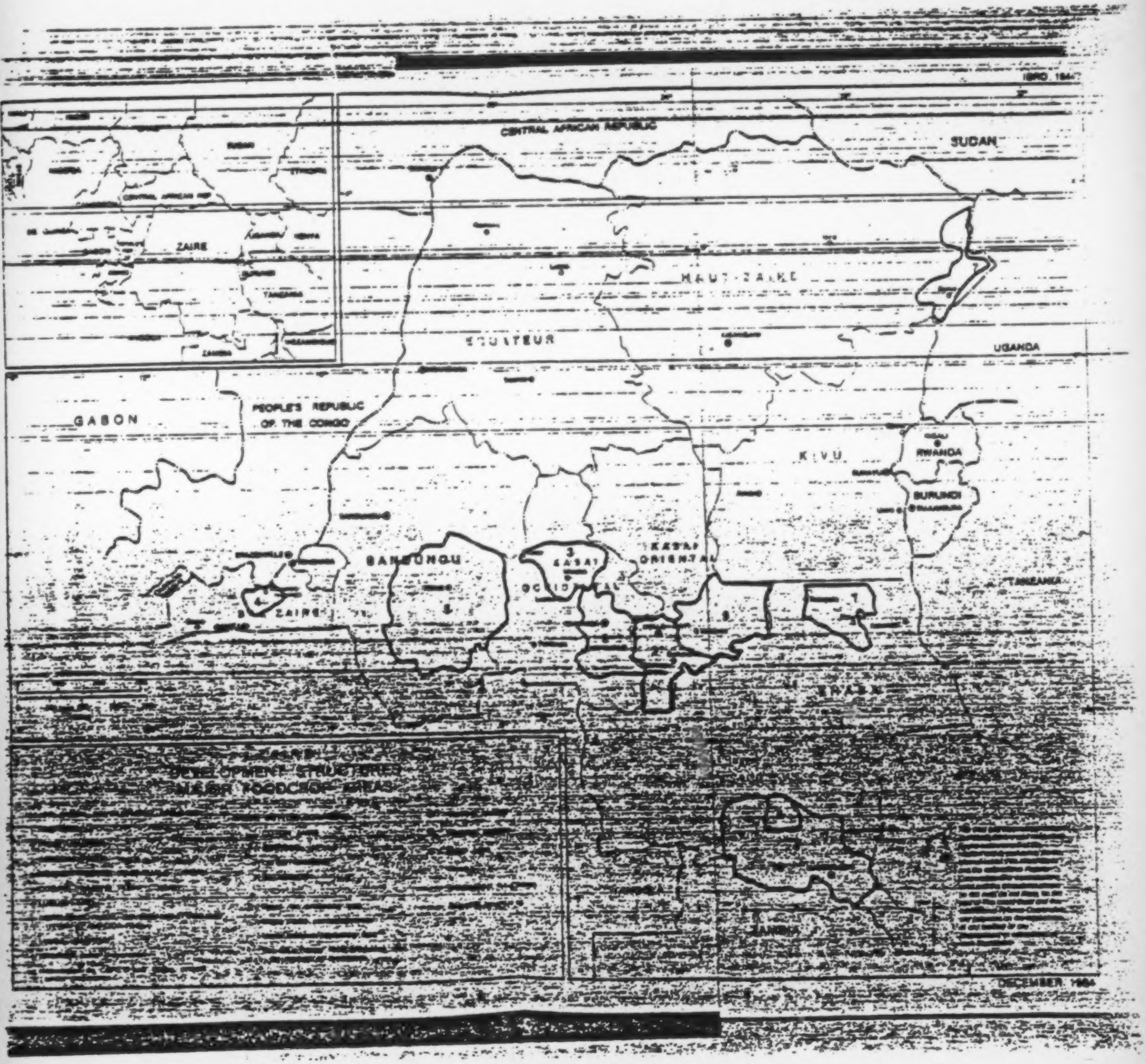
FIGURE 3: LOCATION OF MAJOR DEVELOPMENT PROJECTS, ZAIRE


IBRD 18447
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SUDAN
HAUT-ZAIRE
EQUATEUR
UGANDA
GABON
PEOPLE'S REPUBLIC OF THE CONGO
KIVU
RWANDA
BURUNDI
BANDUNDU
KASAI OCCIDENTAL
KASAI ORIENTAL
ZAIRE
TANZANIA
SHABA
ZAMBIA
ZAIRE
DEVELOPMENT STRUCTURES
MAJOR FOODCROP AREAS
DECEMBER 1984
1
2
3
4
5
6
7

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TABLE 2--ZAIRE

PRODUCTION BY COMMODITY, VALUE AND INDICES OF AGRICULTURE AND FOOD PRODUCTION

COMMODITY	PRICE WEIGHT	AVERAGE 1976-78	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	DOLLARS	-1,000 METRIC TONS-										
WHEAT	163	3	2	2	3	4	5	6	4	5	6	6
RICE, PADDY ?	516	213	208	212	214	213	230	246	246	254	258	267
CORN	210	507	495	510	510	500	509	562	639	687	668	690
MILLET	87	53	52	54	53	53	40	30	50	50	50	50
D PULSES	268	148	187	148	150	146	156	160	163	167	170	160
R POTATOES	370	32	45	33	33	31	31	33	35	35	35	30
R CASSAVA	287	11,943	9,172	11,910	12,139	11,779	12,430	12,784	13,700	14,100	14,600	15,000
SWEETPOTATOES	204	304	360	306	307	298	300	303	307	309	310	310
COTTON	716	9	17	9	12	6	6	10	7	8	11	12
CONGO JUTE	486	4	4	4	4	3	2	2	1	1	1	1
COTTONSEED	125	20	36	18	27	16	13	19	14	16	22	24
C PEANUTS, IN SHELL	536	314	268	316	320	307	334	340	347	357	367	375
SESAME SEED	112	3	4	4	3	3	4	4	4	4	4	4
T BANANAS AND PLANTAINS	326	1,733	1,697	1,735	1,752	1,713	1,730	1,765	1,800	1,820	1,820	1,800
COFFEE	469	83	83	86	77	87	79	88	80	84	89	83
COCOA BEANS	639	5	5	5	5	4	4	4	5	5	4	5
TEA	855	5	6	6	7	3	3	3	5	5	5	4
RUBBER	643	29	29	31	30	26	22	20	20	22	23	23
C SUGAR, RAW	258	50	63	46	54	49	48	48	47	52	54	65
PALM OIL	735	154	165	155	150	158	158	151	157	175	159	157
PALM KERNELS	223	64	74	63	54	76	76	73	76	78	75	75
BEEF AND VEAL	2,432	21	21	21	21	21	22	22	22	23	23	23
GOAT MEAT	1,903	7	7	7	7	7	7	7	7	7	7	7
PORK	2,685	27	27	27	27	27	27	29	30	31	31	30
POULTRY MEAT	2,148	13	13	13	14	13	14	15	19	28	35	35
AGGREGATES OF PRODUCTION		MILLION DOLLARS AT CONSTANT PRICES										
CROPS		4,713.1	3,924.4	4,708.3	4,779.2	4,651.6	4,863.9	5,002.1	5,300.2	5,461.8	5,603.3	5,724.5
LIVESTOCK		165.5	164.8	164.8	167.0	164.8	169.4	176.9	188.2	212.5	227.6	225.0
LIVESTOCK FEED DEDUCTION=.06		-9.9	-9.8	-9.8	-10.0	-9.8	-10.1	-10.6	-11.2	-12.7	-13.6	-13.5
TOTAL AGRICULTURE		4,868.7	4,079.4	4,863.3	4,936.2	4,806.6	5,023.2	5,168.4	5,477.2	5,661.6	5,817.3	5,936.0
TOTAL FOOD		4,798.3	4,002.7	4,789.7	4,864.3	4,740.7	4,964.1	5,103.4	5,417.0	5,597.6	5,748.1	5,865.1
INDICES OF PRODUCTION		(1976-78 = 100)										
CROPS		100	83	100	101	99	103	106	112	116	119	121
TOTAL AGRICULTURE		100	84	100	101	99	103	106	112	116	119	122
TOTAL FOOD		100	83	100	101	99	103	106	113	117	120	122
PER CAPITA AGRICULTURE		100	88	102	102	96	98	98	101	101	101	100
PER CAPITA FOOD		100	88	102	102	96	98	98	101	102	101	101
INDEX OF POPULATION 1976-78 POPULATION= 26,399,000		100.0	94.7	97.5	99.6	102.0	105.8	108.4	111.7	114.9	118.1	121.4

SOURCE (U.S.D.A.)

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TABLE 3.D
ZAIRE: EXPORTS BY COMMODITY, 1972-81
(VALUE IN MILLIONS US$; VOLUME IN THS. METRIC TONS;
UNIT VALUE IN $/THS MT, UNLESS INDICATED)

ITEM		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
* * VALUE * *											
COPPER	1	407.2	651.8	904.1	483.6	578.9	476.2	480.0	735.7	978.1	806.3
GECAMINES	4	-	-	-	431.0	404.6	442.0	461.5	679.0	911.7	750.8
SODIMIZA	7	-	-	-	52.6	174.3	34.2	18.5	56.7	66.4	55.5
COBALT	10	53.6	77.2	71.5	92.1	113.9	104.9	260.0	577.5	413.3	168.7
ZINC	13	23.8	32.6	52.0	29.7	50.3	32.5	16.9	23.3	21.4	68.8
CASSITERITE	19	14.7	13.4	21.7	15.6	20.7	27.0	28.3	18.8	23.8	17.8
SILVER	16	-	-	7.4	6.2	7.3	7.2	10.9	23.5	54.4	21.9
GOLD	22	7.0	9.2	15.9	13.4	9.6	6.7	6.9	12.9	22.4	14.8
DIAMONDS	31	42.8	57.4	62.5	61.5	58.6	64.5	125.0	98.7	96.5	66.8
COFFEE	37	56.0	72.6	60.4	54.3	127.6	193.3	163.7	144.5	163.1	104.2
PALM OIL & PALM KERNEL OIL	34	25.2	27.1	57.0	41.0	18.5	23.0	11.7	8.7	15.0	11.3
RUBBER	40	11.0	15.4	18.3	11.7	14.3	23.9	20.1	16.6	19.8	20.8
CRUDE OIL	43	-	-	-	-	7.6	1.0	-	152.7	228.2	259.9
OTHER	46	57.0	86.6	83.2	47.5	50.8	267.9	449.1	120.7	89.9	113.7
LESS MARKETING COSTS	126	-12.6	-12.8	-15.0	-12.4	-	-	-	-211.0	-240.4	-181.4
ADJUSTMENT	47	5.1	6.7	6.8	9.0	-	-	2.4	111.4	69.4	-
TOTAL EXPORTS FOB	48	690.8	1,037.2	1,345.8	853.2	1,058.1	1,228.1	1,575.0	1,834.0	1,954.9	1,493.6
O.W. GECAMINES	49	-	-	-	-	-	-	-	1,087.6	1,128.2	830.0
* * VOLUME * *											
COPPER	2	448.0	485.0	477.5	455.9	461.4	481.5	423.9	383.6	460.0	472.5
GECAMINES	5	-	-	-	410.4	396.0	446.7	411.2	354.0	436.7	440.0
SODIMIZA	8	-	-	-	45.5	65.4	34.8	12.7	29.6	23.3	32.5
COBALT	11	14.9	18.2	13.5	11.9	12.8	10.2	13.1	12.0	8.0	4.5
ZINC	14	69.6	68.8	62.0	44.4	30.0	63.8	41.3	31.5	29.6	80.0
CASSITERITE	20	6.3	6.8	6.0	6.0	5.0	4.4	3.6	2.5	2.8	7.5
SILVER (METRIC TONS)	17	51.7	49.6	41.0	57.0	48.3	67.9	71.3	68.0	83.5	59.7
GOLD (METRIC TONS)	23	3.1	2.5	6.1	3.4	2.6	2.3	1.3	1.4	1.1	1.3
DIAMONDS (MILL CARATS)	32	12.0	14.2	13.1	12.9	12.2	11.5	11.1	8.2	8.7	6.7
COFFEE	38	74.0	66.9	77.7	58.9	108.6	64.1	81.8	62.8	74.1	63.0
PALM OIL & PALM KERNEL OIL	35	124.2	102.5	96.4	81.8	62.4	36.5	26.8	17.6	28.7	25.1
RUBBER	41	37.7	30.2	26.6	24.2	21.1	27.6	26.1	16.6	19.8	21.0
CRUDE OIL (MILL BLS)	44	-	-	-	-	9.1	8.3	6.6	7.5	6.6	7.3

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TABLE 3.10 (cont'd)
ZAIRE: EXPORTS BY COMMODITY, 1972-81
(VALUE IN MILLIONS US$; VOLUME IN THS. METRIC TONS;
UNIT VALUE IN $/THS MT, UNLESS INDICATED)

ITEM		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
						* * UNIT VALUE * *					
COPPER	3	908.9	1,343.9	1,893.4	1,060.8	1,254.7	989.0	1,132.3	1,917.9	2,126.3	1,706.5
GECAMINES	6	-	-	-	1,050.2	1,021.7	989.5	1,122.3	1,918.1	2,087.8	1,704.4
SODIMIZA	9	-	-	-	1,156.0	2,665.1	982.8	1,456.7	1,917.3	2,849.8	1,767.7
COBALT	12	3,597.3	4,241.8	5,296.3	7,739.5	8,898.4	10,284.3	19,847.3	48,125.0	51,662.5	37,488.9
ZINC	15	342.0	473.8	838.7	668.9	1,676.7	509.4	409.2	740.5	723.0	860.0
CASSITERITE	21	2,333.3	1,970.6	3,616.7	2,600.0	4,140.0	6,136.4	7,861.1	7,520.0	8,500.0	2,373.3
SILVER	18	-	-	180.5	108.8	151.1	106.0	152.9	345.6	651.5	366.8
GOLD	24	2,258.1	3,680.0	2,606.6	3,941.2	3,692.3	2,913.0	5,307.7	9,214.3	20,363.6	11,384.6
DIAMONDS ($/THS CARATS)	33	3,566.7	4,042.3	4,771.0	4,767.4	4,803.3	5,608.7	11,261.3	12,036.6	11,092.0	9,970.1
COFFEE	39	756.8	1,085.2	777.3	921.9	1,175.0	3,015.6	2,001.2	2,301.0	2,200.4	1,654.0
PALM OIL & PALM KERNEL OIL	36	202.9	264.4	591.3	501.2	296.5	630.1	436.6	494.3	522.6	450.2
RUBBER	42	291.8	509.9	688.0	483.5	677.7	865.9	770.1	1,000.0	1,000.0	990.5
CRUDE OIL ($/BL)	45	-	-	-	-	-	109.4	-	20.3	34.5	35.8

SOURCE: IMF AND BANK OF ZAIRE

NOTE: 1981 FIGURES ARE PRELIMINARY.

DATA SET: ZAI/3T.

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Table 4. Division of agricultural labor

	Individual(s) performing tasks in household, n = 100				
Activity	Men	Women	Men and women together	Children assisted by other family member	Hired labor assisted by family members
			(percent)		
Cleaning and burning fields	39	3	36	8	14
Digging before planting	48	0	27	16	9
Planting of crops	10	33	29	20	8
First weeding of fields	11	4	56	19	10
Second weeding of fields	9	13	50	16	12
Harvesting crop	9	24	39	19	9
Corn shelling	9	32	34	23	2

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ZAIRE-OTA

6

Table 5 Response to decision making questions by household member categories

Who in the household makes the decision	What to plant	Where to plant	When to plant new fields	Amount of corn	Type of corn seeds	Method of planting corn
Household head	244 (95.7%)	245 (96.1%)	243 (95.3%)	229 (89.8%)	229 (89.8%)	240 (94.1%)
Wife	4 (1.6%)	4 (1.6%)	6 (2.4%)	15 (5.9%)	16 (6.3%)	8 (3.1%)
Household head and wife	1 (0.4%)			5 (2.0%)	3 (1.2%)	
Child		3 (1.2%)	3 (1.2%)	3 (1.2%)	4 (1.6%)	4 (1.6%)
Household head, wife and child						
Wife and child	3 (1.2%)					
Household head and child						
Does not apply	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)
n = 255	255 (100%)	255 (100%)	255 (100%)	255 (100%)	255 (100%)	255 (100%)

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ZAIRE - OTA

Table 5 Continued

Who in the household makes the decision	Date of planting	Date of weeding	Date of harvest	Disposition of harvest	What produce is sold	What amount is sold	Where produce is sold	Composite
Household head	242 (94.9%)	239 (93.7%)	231 (90.6%)	66 (25.9%)	241 (94.5%)	234 (91.8%)	239 (93.7%)	88.5%
Wife	7 (2.7%)	10 (3.9%)	13 (5.1%)	155 (60.8%)	6 (2.4%)	11 (4.3%)	7 (2.7%)	7.9%
Household head and wife			3 (1.2%)	20 (7.8%)		2 (0.8%)		1.1%
Child	3 (1.2%)	3 (1.2%)	3 (1.2%)	2 (0.8%)	5 (2.0%)	5 (2.0%)	5 (2.0%)	1.2%
Household head, wife and child				2 (0.8%)			1 (0.4%)	.09%
Wife and child			2 (0.8%)	5 (2.0%)				.3%
Household head and child				2 (0.8%)				.06%
Does not apply	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	3 (1.2%)	.7%
n = 255	255 (100%)	255 (100%)	255 (100%)	255 (100%)	255 (100%)	255 (100%)	255 (100%)	(100%)

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Table $\overset{5}{6}$. Farming system: 14-year cycle[a] - KONGOLO, N. SHABA, ZAIRE

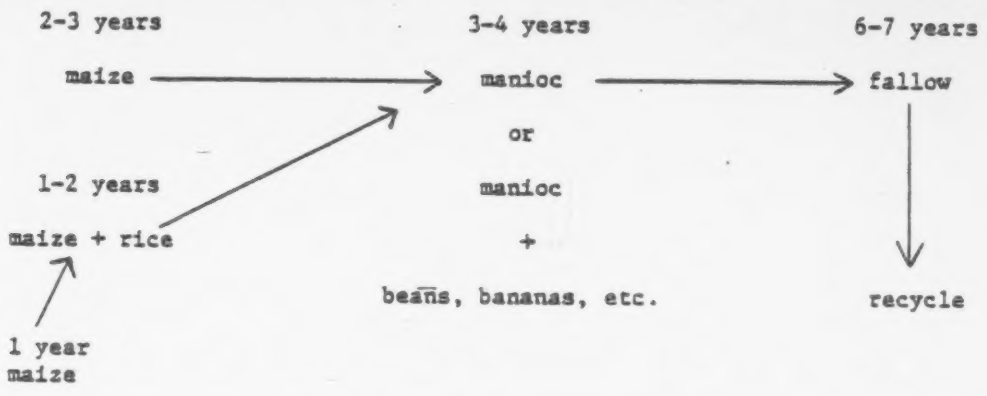
2-3 years
maize
3-4 years
manioc
or
manioc
+
beans, bananas, etc.
6-7 years
fallow
recycle
1-2 years
maize + rice
1 year
maize

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Table 7. Consumption chart of a shifting cultivator's family in Kongoy, Zaire[a]

Product (Crops produced by the family)	Month 1	2	3	4	5	6	7	8	9	10	11	12
1) Staple foods containing starch												
Manioc	X	X	X	X	X	X	X	X	X	X	X	X
Maize	X	X	X	X	X	X	X	X	X	X	X	X
Rice					X	X						
Sweet potatoes				X	X							
Plaintains/bananas	X	X	X	X	X	X	X	X	X	X	X	X
2) Staple foods containing protein												
Beans			X	X							X	
Manioc leaves	X	X	X	X	X	X	X	X	X	X	X	X
Sweet potato leaves						X	X	X				
Bean and squash leaves							X	X	X			
Ground nuts	X	X	X	X	X	X	X	X	X	X	X	X
Grain amarathus	X	X	X	X	X					X	X	X
Bambura ground nuts (voandzeia sub-terranea)	X	X										X
Lentils			X	X							X	
3) Fruits and nuts												
Onions	X	X	X	X							X	X
Tomatoes		X	X	X	X	X				X	X	X
Eggplant	X	X	X	X							X	X
Okra	X	X	X								X	X
Sugar cane			X	X								
Pumpkins/squash	X	X	X							X	X	X
Citrus (oranges, tangerines, lemons, grapefruit)					X	X	X					
Oil palm nuts and oil	X	X	X	X	X	X	X	X	X	X	X	X
4) Collected foods												
Termites (white ants)										X	X	
Various fruits	X	X	X	X	X	X	X	X	X	X	X	X

[a] Observed by researcher, 1978-80.

Contract Paper No. 11

DRAFT

The Role of Low-Resource Agriculture in Africa: Zimbabwe Supplementary Information

by

by Brian D'Silva and Arthur Dommen
Economic Research Service
U.S. Department of Agriculture

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Congress of the United States
Office of Technology Assessment

September 1986

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LOW RESOURCE AFRICAN AGRICULTURE

ZIMBABWE Supplementary Information

1. Production statistics.

a. Aggregate data by agroecological zone and classification of farmer are shown in Table 1 for maize,sorghum, wheat, cotton, grooundnuts, soyabeans and tobacco. These data are for 1982. Figure 1 is a political map of Zimbabwe while Figure 2 is a map showing the agroecological zones within Zimbabwe.

b. In 1981, agriculture contributed 18 percent of total GDP. The value of agriculture output by sector(i.e. communal and commercial)for the period 1976-1982 is shown in Table 2. The structure of agricultural employment is different by sector with most labor in the commercial farms being for wages and labor in communal areas being self-employed. In 1980, over 32 % of the formal wage earning work force in the country was involved in the commercial sector. The increases in agricultural production in 1984 and 1985, especially in the communal areas suggest increased employment in the communal sector.

c. The value of selected agricultural commodity exports for 1975,1979,1980 and 1981 are shown in Table 3, while the share of agricultural exports in relation to total exports for 1975-1982 is shown in Table 4.

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2. Producers

Due to the structural characteristics of the agricultural sector and to changes that have been taking place in the agricultural sector since Independence, there are no national survey results available as yet. However, a survey program to generate socio-economic characteristics of the population was begun in 1983 by the Central Statistical Office. These surveys will be completed in 1987/88. We provide data which are now available from these surveys which have initially focussed on the communal sector. The provinces that we have been able to provide data for are :

Mashonaland Central and Mashonaland East, both of which fall into the SHT agroecological zone and Masvingo and Midlands which fall into the ASA zone. Data provide by province include tables on :

1. Distribution of population by age and sex
2. Primary activity of labour force by sex
3. Distribution of household heads by age and sex
4. Percentage of households receiving or giving remittances
5. Distribution of households by holding size
6. Distribution of hosuseholds by number of cattle

The above data are found in Tables 5-33 and provide a socio-economic profile of communal agricultural producers. There are however no detailed surveys which attempt to delineate sources of agricultural income by crop and sex. However, it is known that groundnuts which is a cash crop is primarily grown by women.

Data on aggreagate livestock production by sector are provided in Tables 34-36. Together with data provided on distribution of producers owning livestock in the communal sector this should provide an indicator of the importance of livestock earnings for communal sector farmers.

3. Method of Production.

a. Irrigated/rainfed.

In 1980. approximately 27 % of total cropped area in the commercial sector was under irrigation (i.e. 155,000 ha out of 575,000 ha). In the communal sector at the same time period, only 1.3 % of total cropped area was irrigated (i.e. 12,000 ha out of 933,000 ha). There has however been increases in irrigated area in the communal sector since then. Crops grown under irrigation include wheat, cotton, maize, soyabeans, sugarcane, and coffee. The major irrigation areas are found in the ASA agroecological zone.

b. Types and amounts of commercial inputs.

Use of commercial inputs, especially chemical fertilizer has been increasing rapidly in the communal areas in the last 5 years. We provide aggregate estimates of fertilizer use by crop for 1981 and the extent to which the fertilizer has been imported. These are found in tables 37-38 An indicator of the differential yields and use levels for commercial and small scale farmers is shown in tables 39-40.

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c. Intercropping/monocropping. Most of the crop production takes place under sole cropped conditions. Intercropping is primarily practised in the communal areas with crops like sorghum. Double cropping is however practised in the irrigated areas with cropping intensities of upto 150 %; being found in some of the irrigated schemes.

4. Consumption and Storage.

As seen earlier agriculture is not only a major source of employment but also of export earnings for the country. The breakdown between domestic consumption and exports has varied over the last five years because of drought, population growth and recent increases in agriucultural production. Tables 41-45 however provide an indicator of the distribution between domestic consumption and exports for major crops.

As the Government plays a major role in marketing of agricultural commodities, most of the modern storage capacity is controlled by the Government. This capacity is estimated at 600,000 m. tons. On farm storage is available in the communal areas but there are no estimates on these data. There are however on going research studies at the University of Zimbabwe which should be able to provide an indicator of the level of on farm storage in the communal areas when they are completed in 1987/88.

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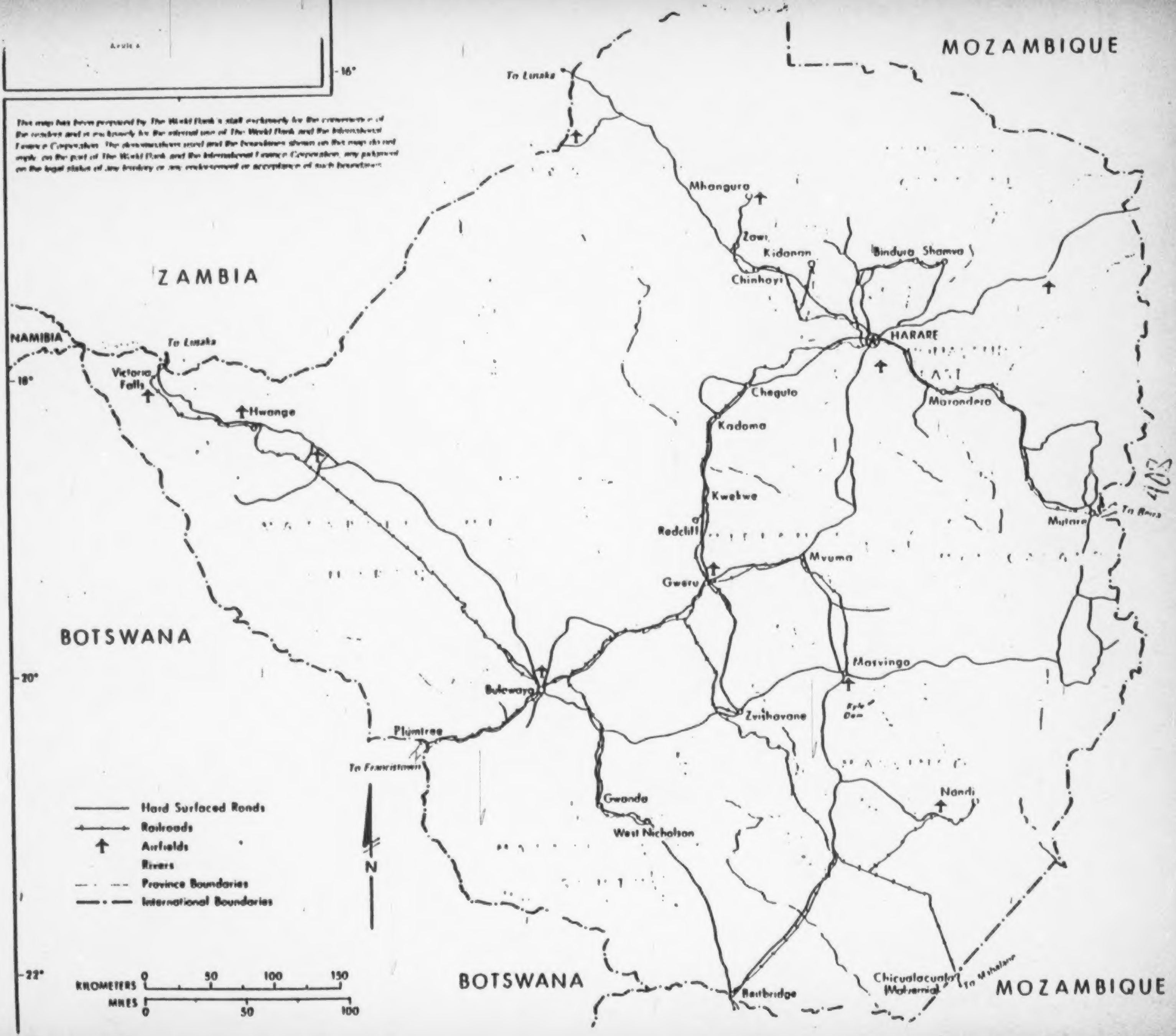
FIGURE 1.
ZIMBABWE
POLITICAL


Africa
MOZAMBIQUE
ZAMBIA
NAMIBIA
BOTSWANA
BOTSWANA
MOZAMBIQUE
To Lusaka
To Lusaka
Victoria Falls
Hwange
Mhangura
Zawi
Kidonan
Chinhoyi
Bindura
Shamva
HARARE
Chegutu
Kadoma
Marondera
Kwekwe
Redcliff
Mvuma
Gweru
Mutare
To Beira
Bulawayo
Plumtree
To Francistown
Masvingo
Kyle Dam
Zvishavane
Gwanda
West Nicholson
Nandi
Beitbridge
Chicualacuala (Malvernia)
To Mabalane
16°
18°
20°
22°
15°
18°
20°
22°
N
Hard Surfaced Roads
Railroads
Airfields
Rivers
Province Boundaries
International Boundaries
KILOMETERS 0 50 100 150
MILES 0 50 100

This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

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TABLE 1.

----AGGREGATE DATA BY ZONE 1982----

	----ZONE-----						------NATIONAL-----	
	-----ASA-----		----SHT-----					
CROP	----COMMERCIAL FARMERS-----				---TOTAL---		----USDA 1982 ESTIAMTES---	
----	---AREA	---PROD	----AREA	---PROD	----AREA	----PROD	----AREA	----PROD
MAIZE	35.79	76.779	271.35	1112.8	307.14	1189.579	1307.14	1786
SORGHUM	1.58	1.69	6.654	15.646	8.234	17.336	87.9652	117
WHEAT	3.409	16.126	33.96	175.75	37.369	191.876	75.3922	213
COTTON	6.454	15.221	50.56	92.66	57.014	107.881	117.514	154
GNUTS	3.32	1.09	8.587	15.286	11.907	16.376	100.6686	115
SOYABEANS	2.198	3.633	46.218	37.963	48.416	41.596	74.4882	69
TOBACCO			48.866	88.423	48.866	88.423	54.3564	93
MILLET								
TOTAL	52.751		466.175		518.946			

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:S---

-----DATA BY AGROECOLOGICAL ZONE----

----SHT ZONE---		-----ASA ZONE----	
----AREA	-----PROD	----AREA	-----PROD
756.35	1362.8	550.79	423.2
47.154	75.646	40.8112	41.354
54.96	175.75	20.4322	37.25
89.1	132.66	28.414	21.34
71.5	81.8572	29.1686	33.1428
66.2	77.963	8.2882	11.037
54.3584	93		

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TABLE 1. (CONT'D).

CROP	NATIONAL		LRA			
	COMMUNAL RESIDUAL		ASA		SHT	
	AREA	PROD	AREA	PROD	AREA	PROD
MAIZE	1000	596.421	165	150	135	150
SORGHUM	79.7312	99.664		15		20
WHEAT	38.0232	21.124				
COTTON	60.5	46.119				
GNUTS	88.7616	98.624		22.1904		36.5712
SOYABEANS	26.0722	47.404				
TOBACCO	5.4924	4.577				
MILLET						
TOTAL						

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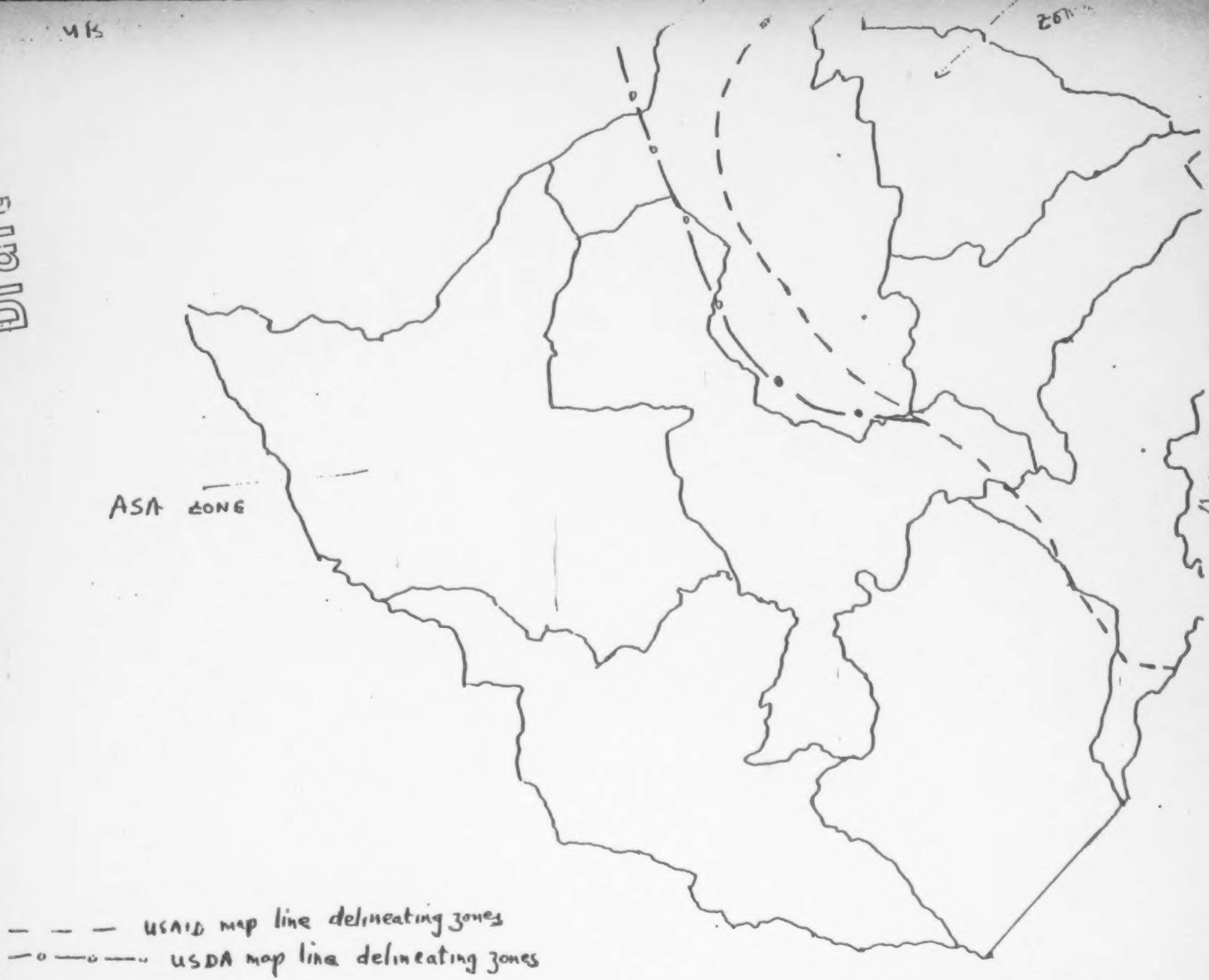
ASA ZONE
— — — USAID map line delineating zones
—o—o—. USDA map line delineating zones

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TABLE 2. Value of Agricultural Output by Sector ($ million)

Year	Communal Farming Areas			Commercial Sector	National Total
	Sales to Marketing Agencies	Production for own Consumption	Total		
1976	28	80	108	401	509
1977	22	84	106	393	499
1978	22	52	74	418	493
1979	17	86	102	439	541
1980	29	117	146	592	738
1981	80	185	265	784	1 049
1982	85	187	272	842	1 114

Source: C.S.O., HARARE

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TABLE 3.

Selected Agricultural Commodity Exports

Export Commodity	1975		1979		1980		1981	
–	000t	$m	000t	$m	000t	$m	000t	$m
Tobacco	58	68	60	85	94	123	131	224
Cotton lint	33	19	49	46	54	57	54	60
Sugar(1)	157	44	245	21	166	47	172	55
Coffee/tea	8	7	12	18	9	13	11	16
Maize	842	47	219	17	63	7	238	35
Beef(2)	41	24	44	31	12	12	2	4
Hides	11	2	11	9	7	4	4	2
Oilseeds(3)	22	3	4	2	2	1	3	2
Total	1 172	214	644	229	407	264	615	398
Average Value $/t	183		356		649		647	

Notes (1) raw and refined

(2) fresh, frozen and chilled

(3) soyabeans, groundnuts, sunflowerseed, cottonseed

(all figures rounded to nearest thousand)

Source: C.S.O. (Statement of External Trade)

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TABLE 4. Agricultural Exports in Relation to Total Exports

Year	Total Exports(1) ($m)	Agricultural Exports(2) ($m)	Agricultural Share (%)
1975	478	220	46
1976	518	211	40
1977	501	210	41
1978	559	252	45
1979	645	247	38
1980	788	278	35
1981	888	413	46
1982	807	517	64

Notes: (1) Excludes Gold

(2) Includes "other" meat, malting barley, animal feed and legumes not included in the previous table.

Source: C.S.O.

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DATA FROM SOCIO_ECONOMIC SURVEY OF MASHONALAND C. PROVI

POPULATION AND DEMOGRAPHIC CHARACTERISTICS

Estimates on population by age and sex are as follows :

Table 5 : Distribution of population by 5 year age groups, and sex.

Age Group	Males	Females	Total
0 - 4	31242	31325	62567
5 - 9	32188	31119	63307
10 - 14	30215	28241	58456
15 - 19	19403	18005	37408
20 - 24	7399	13525	20924
25 - 29	5139	11593	16732
30 - 34	4357	10318	14675
35 - 39	4686	8057	12743
40 - 44	4110	7194	11304
45 - 49	3371	5139	8510
50 - 54	2672	4727	7399
55 - 59	2549	3206	5755
60 and above	9414	10565	19979
Total	156 745	183 014	339 759

In order to highlight some significant points in the age distribution, the above table is summarised and presented in terms of percentages.

Table 6 : Percentages of males and females in broad age groups and sex ratios

Broad Age Group	Male	Female	Total	Sex Ratio of Male to Female
0 - 9	40,4	34,1	37,0	1,02
10 - 19	31,7	25,3	28,2	1,07
20 - 29	8,0	13,7	11,7	0,50
30 - 39	5,8	10,0	8,1	0,49
40 - 49	4,8	6,7	5,8	0,61
50 - 59	3,3	4,4	3,9	0,65
60 and above	6,0	5,8	5,9	0,89
Total	100,0	100,0	100,0	0,86

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MASHONALAND CENTRAL PROVINCE DATA CONT'D

Table 7 : Distribution of population aged 10 years and above by primary activity status

Primary Activity	Males	Females	Total
Working (for pay or profit in cash or in kind) including unpaid family workers	74 406	90 315	164 721
Had job, but did not work last week	13 566	22 692	36 258
Looking for work or available for work (with previous experience)	123	411	534
Looking for work or available for work (without work experience)	1 192	0	1 192
Home maker or housewife	0	2 878	2 878
Attending school or college or training course	1 809	1 315	3 124
Unable to work (disabled or too young or too old)	1 932	2 795	4 727
Unwilling to work (living on remittance, charity, aid, pension, rent, dividend interest, etc.)	288	123	411
Other	0	71	71
Total	93 316	120 570	213 886

Labor force

MASHONALAND CENTRAL PROVINCE DATA CONT'd

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The head of a household is a person (Male or Female) who usually lives in that household and is regarded by the members of the household as its head. The distribution of heads of households by age and sex was found to be as follows:

Table 8: Distribution of heads of households by age and sex.

Age Group	Males	Females	Total
10 - 14	82	0	82
15 - 19	329	411	740
20 - 24	1357	2919	4276
25 - 29	2672	4686	7358
30 - 34	3206	4727	7933
35 - 39	4193	3371	7564
40 - 44	4193	3289	7482
45 - 49	3206	2138	5344
50 - 54	2754	2508	5262
55 - 59	2590	1521	4111
60 and above	9003	5426	14429
Total	33585	30996	64581

Among the heads of households, 52% were males and 48% were females. About 55% of heads were aged 25 to 49 and 37% were over 50. The reason why there are many women and old people as heads of households is that many young men left the area to work elsewhere, most probably in the big urban areas.

The majority of heads (90%) were engaged in agriculture. 10% were either teachers or were involved in activities such as construction, trade, and manufacturing. About 2% of heads were dependents supported by relatives (i.e. living on remittances).

Table 9 : Percentages of Households Receiving or Giving Remittances

(Sub-sample results)

Remittances	Percentage of household
Receiving	31
Giving	6
None	63
Total	100

The pattern reflected in table 8 where more households received remittances from relatives working in other areas is characteristic of all other communal lands.

MASHONALAND CENTRAL PROVINCE DATA CONT'D

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TABLE 10 - DOES NOT EXIST

Table 11 : Distribution of households by holding size (acres)

Holding Size (acres)	Number of Households	Percentage of Households
0	4 563	7,1
Less than 1	2 014	3,1
1 but less than 2	6 742	10,4
2 " " " 3	7 482	11,6
3 " " " 4	8 962	13,9
4 " " " 5	8 139	12,6
5 " " " 6	6 577	10,1
6 " " " 7	4 851	7,5
7 " " " 8	3 905	0,1
8 " " " 9	3 494	5,4
9 " " " 10	3 371	5,2
10 and above	4 481	6,9
Total	64 581	100,0

Table 12 : Distribution of households by number of cattle

Number of Cattle	Number of Households	Percentage of Households
0	31900	49,4
1 - 5	17882	27,7
6 - 10	8345	12,9
11 - 15	3330	5,2
16 - 20	1480	2,3
21 - 25	740	1,1
26 - 30	247	0,4
31 - 35	164	0,2
36 - 40	247	0,4
41 - 45	41	0,1
46 - 50	82	0,1
Above 50	123	0,2
Total	64581	100,0

DATA FROM SCOIO_ECONOMIC SURVEY OF MASHONALAND EAST PROVINCE

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_ POPULATION AND DEMOGRAPHIC CHARACTERISTICS

Estimates on population by age and sex are as follows :

Table 13: Distribution of population by 5 year age groups, and sex.

Age Group	Males	Females	Total
0 - 4	40513	43021	83534
5 - 9	42379	42800	85179
10 - 14	42579	40919	83498
15 - 19	24832	25238	50070
20 - 24	12176	19334	31510
25 - 29	7822	16567	24389
30 - 34	6199	12360	18559
35 - 39	5904	9483	15387
40 - 44	4686	7822	12508
45 - 49	4353	8634	12987
50 - 54	4797	6125	.0922
55 - 59	3837	5129	8966
60 and above	11032	17526	28558
Total	211 109	254 958	466 067

In order to highlight some significant points in the age distribution, the above table is summarised and presented in terms of percentages.

Table/4: Percentages of males and females in broad age groups and sex ratios

Broad Age Group	Male	Female	Total	Sex Ratio of Male to Female
0 - 4	19,2	16,9	17,9	0,94
5 - 9	20,1	16,8	18,3	0,99
10 - 19	31,9	25,9	28,6	1,02
20 - 29	9,5	14,1	12,0	0,56
30 - 39	5,7	8,6	7,3	0,55
40 - 49	4,3	6,5	5,5	0,55
50 - 59	4,1	4,4	4,3	0,77
60 and above	5,2	6,8	6,1	0,63
Total	100,0	100,0	100,0	0,83

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Table/5 : Distribution of population aged 10 years and above by primary activity status

Primary Activity	Males	Females	Total
Working (for pay or profit in cash or in kind) including unpaid family workers	120 873	159 580	280 455
Had job, but did not work last week	332	295	627
Looking for work or available for work (with previous experience)	111	0	111
Looking for work or available for work (without work experience)	74	37	111
Home maker or housewife	0	1 550	1 550
Attending school or college or training course	4 944	8 413	13 357
Unable to work (disabled or too young or too old)	1 882	3 468	5 350
Unwilling to work (living on remittance, charity, aid, pension, rent, dividend interest, etc.)	0	258	258
Other	0	258	258
Total	128 218	173 859	302 077

MASHONALAND EAST PROVINCE DATA CONT'D

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The head of a household is a person (Male or Female) who usually lives in that household and is regarded by the members of the household as its head. The distribution of heads of households by age and sex was found to be as follows:

Table 16: Distribution of heads of households by age and sex.

Age Group	Males	Females	Total
10 - 14	74	148	222
15 - 19	738	2398	3136
20 - 24	3395	7269	10664
25 - 29	4944	7970	12914
30 - 34	4907	5867	10774
35 - 39	4907	5534	10441
40 - 44	3911	4096	8007
45 - 49	4058	4096	8154
50 - 54	4354	3431	7785
55 - 59	3284	2730	6014
60 and above	10995	10700	21695
Total	45567	54239	99806

Among the heads of households, 46% were males and 54% were females. About 45% of heads were aged 20 to 39 and 36% were over 50. The reason why there are many women and old people as heads of households is that many young men left the area to work elsewhere, most probably in the big urban areas.

The majority of heads (90%) were engaged in agriculture. 10% were either teachers or were involved in activities such as construction, trade, and manufacturing. About 6% of heads were dependents supported by relatives (i.e. living on remittances).

Table 17 : Percentages of Households Receiving or Giving Remittances

(Sub-sample results)

Remittances	Percentage of household
Receiving	37,9
Giving	13,1
None	49,0
Total	100,0

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DATA FROM MASHONALAND EAST PROVINCE CONT'D

Table 18 : Distribution of households by holding size (acres)

Holding Size (acres)	Number of Households	Percentage of Households
0	10626	10,6
Less than 1	3837	3,8
1 but less than 2	14242	14,3
2 " " " 3	14501	14,5
3 " " " 4	13431	13,5
4 " " " 5	9962	10,0
5 " " " 6	8080	8,1
6 " " " 7	7379	7,4
7 " " " 8	5387	5,4
8 " " " 9	4391	4,4
9 " " " 10	2804	2,8
10 and above	5166	5,2
Total	99806	100,0

Table 19 : Distribution of households by number of cattle

Number of Cattle	Number of Households	Percentage of Households
0	54386	54,5
1 - 5	25939	26,0
6 - 10	11807	11,8
11 - 15	4870	4,9
16 - 20	1328	1,4
21 - 25	960	0,9
26 - 30	221	0,2
31 - 35	221	0,2
36 and above	74	0,1
Total	99806	100,0

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DATA FROM SOCIOECONOMIC SURVEY OF MASVINGO PROVINCE

POPULATION AND DEMOGRAPHIC CHARACTERISTICS IN THE COMMUNAL LANDS (DISTRICT COUNCILS) OF MASVINGO PROVINCE

Estimates on population by age and sex are as follows

Table 20: Distribution of population by 5 year age groups, and sex

Age Group	Males	Females	Total
0 - 4	87085	86306	173391
5 - 9	84132	79374	163506
10 - 14	71621	70021	141642
15 - 19	49470	48978	98448
20 - 24	21659	39420	61079
25 - 29	14316	32078	46394
30 - 34	10378	24325	34703
35 - 39	10214	21741	31955
40 - 44	10132	16326	26458
45 - 49	9271	13126	22397
50 - 54	8245	9599	17844
55 - 59	6645	8122	14767
60 and above	21248	25761	47009
Total	404416	475177	879593

In order to highlight some significant points in the age-sex distribution, the above table is summarised and presented in terms of percentages.

Table 21: Percentages of males and females in broad age groups and sex ratios

Broad Age Group	Male	Female	Total	Sex Ratio of Male to female
0 - 4	21,5	18,2	19,7	1,01
5 - 9	20,8	16,7	18,6	1,06
10 - 19	29,9	25,0	27,3	1,02
20 - 29	8,9	15,1	12,2	0,50
30 - 39	5,1	9,7	7,6	0,95
40 - 49	4,8	6,2	5,5	0,66
50 - 59	3,7	3,7	3,7	0,80
60 and above	5,3	5,4	5,4	0,80
Total	100,0	100,0	100,0	0,85

Table 2 shows a significant drop in the male population from 29,9% in the 10 - 19 age group to 8,9% in the 20 - 29 age group. A similar but less significant pattern is observed among the females. These figures indicate that many young people, particularly males, after reaching a certain age left the Communal Lands of Masvingo Province. There are a number of theories that can be advanced to explain this phenomenon.

MASVINGO PROVINCE DATA CONT'D

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Table29 : Distribution of population aged 10 years and above by primary activity status

Primary Activity	Males	Females	Total
Working (for pay or profit in cash or in kind) including unpaid family workers	178 929	239 352	418 281
Had job, but did not work last week	46 722	61 407	108 129
Looking for work or available for work (with previous work experience)	205	205	410
Looking for work or availble for work (without work experience)	164	41	205
Home maker or housewife	82	287	369
Attending school or college or training course	3 569	2 749	6 318
Unable to work (disabled or too young or too old)	3 487	5 046	8 533
Unwilling to work (living on remittance, charity, aid, pension, rent, dividend, interest, etc.)	41	410	451
Total	233 199	309 497	542 696

MASVINGO PROVINCE DATA CONT'D

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Table 23 Distribution of heads of households by age and sex

Age Group	Males	Females	Total
10 - 14	41	41	82
15 - 19	1108	1723	2831
20 - 24	3446	10296	13472
25 - 29	7589	12716	20305
30 - 34	8614	10214	18828
35 - 39	8983	8327	17310
40 - 44	9681	6030	15711
45 - 49	8573	4266	12839
50 - 54	7999	3282	11281
55 - 59	6276	3241	9517
60 and above	19566	10911	30477
Total	81676	71047	152923

Table 24 Percentages of Households Receiving or Giving Remittances

(Sub-sample results)

Remittances	Percentage of households
Receiving	41,8
Giving	8,6
None	49,6
Total	100,0

MASVINGO PROVINCE DATA CONT'd

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Table 15 : Distribution of households by holding size (acres)

Holding Size (acres)	Number of Households	Percentage of Households
0	9 968	6,5
Less than 1	779	0,5
1 but less than 2	11 403	7,4
2 " " " 3	17 557	11,5
3 " " " 4	19 566	12,8
4 " " " 5	21 823	14,3
5 " " " 6	13 660	8,9
6 " " " 7	15 013	9,8
7 " " " 8	9 558	6,3
8 " " " 9	9 558	6,3
9 " " " 10	6 030	3,9
10 and above	18 008	11,8
Total	152 923	100,9

Table 26 : Distribution of households by number of cattle

Number of Cattle	Number of Households	Percentage of Households
0	65 796	43,0
1 - 5	52 999	34,7
6 - 10	23 258	15,2
11 - 15	6 399	4,2
16 - 20	2 379	1,5
21 - 25	903	0,6
26 - 30	451	0,3
31 - 35	246	0,2
36 and above	492	0,3
Total	152 923	100,0

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DATA FROM MIDLANDS PROVINCE

- POPULATION AND DEMOGRAPHIC CHARACTERISTICS IN THE COMMUNAL LANDS (DISTRICT COUNCILS) OF MIDLANDS PROVINCE

Estimates on population by age and sex are as follows

Table 27 : Distribution of population by 5 year age groups, and sex

Age Group	Males	Females	Total
0 - 4	76626	79811	156437
5 - 9	78110	80752	158862
10 - 14	68699	65514	134213
15 - 19	45317	42421	87738
20 - 24	18242	32359	50601
25 - 29	12415	27074	39489
30 - 34	11040	21826	32866
35 - 39	10460	20993	31453
40 - 44	9519	14116	23635
45 - 49	9013	12343	21356
50 - 54	7673	11148	18821
55 - 59	5900	8072	13972
60 and above	21319	22658	43977
Total	374333	439087	813420

In order to highlight some significant points in the age distribution the above table is summarised and presented in terms of percentages.

Table 28: Percentages of males and females in broad age groups and sex ratios

Broad Age Group	Male	Female	Total	Sex Ratio of Male to female
0 - 4	20	18	19	0,96
5 - 9	21	19	20	[illegible]
10 - 19	30	24	27	1,00
20 - 29	8	14	11	0.52
30 - 39	6	10	8	0.58
40 - 59	5	6	6	0.70
50 - 59	4	4	4	0.71
60 and above	6	5	5	0.95
Total	100	100	100	0.85

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MIDLANDS PROVINCE DATA CONT'D

Table 29 : Distribution of population aged 10 years and above by primary activity status

Primary Activity	Males	Females	Total
Working (for pay or profit in cash or in kind) including unpaid family workers	113 581	163 712	277 293
Had job, but did not work last week	15 564	30 223	45 787
Looking for work or available for work (with previous work experience)	1 339	72	1 411
Looking for work or available for work (without work experience)	1 194	72	1 266
Home maker or housewife	1 629	25 880	27 509
Attending school or college or training course	55 669	51 325	106 994
Unable to work (disabled or too young or too old)	5 900	8 434	14 334
Unwilling to work (living on remittance, charity, aid, pension, rent, dividend interest, etc.)	253	181	434
Other	905	905	1 810
Total	196 034	280 804	476 838

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MIDLANDS DATA CONT'D

Table 30 : Distribution of heads of households by age and sex

Age Group	Males	Females	Total
10 - 14	72	145	217
15 - 19	688	1086	1774
20 - 24	2244	6406	8650
25 - 29	6624	8976	15600
30 - 34	7963	7999	15962
35 - 39	8687	8361	17048
40 - 44	8434	5104	13538
45 - 49	8650	5538	14188
50 - 54	7239	3692	10931
55 - 59	5755	2896	8651
60 and above	18930	9628	28558
Total	75286	59831	135117

Table 31 : Percentages of Households Receiving or Giving Remittances

(Sub-sample results)

Remittances	Percentage of households
Receiving	42
Giving	6
None	52
Total	100

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MIDLANDS DATA CONT'D

Table 32 : Distribution of households by holding size (acres)

Holding Size (acres)	Number of Households	Percentage of Households
0	8 325	6
Less than 1	1 375	1
1 but less than 2	8 723	6
2 " " " 3	12 163	9
3 " "" " 4	15 817	12
4 " " " 5	14 080	10
5 " " " 6	15 093	11
6 " " " 7	9 157	7
7 " " " 8	6 877	5
8 " " " 9	9 085	7
9 " " " 10	6 153	5
10 "and above	18 269	21
Total	135 117	100

Table 33 : Distribution of households by number of cattle

Number of Cattle	Number of households	Percentage of Households
0	54 800	40,6
1 - 5	44 918	33,2
6 - 10	21 862	16,2
11 - 15	7 637	5,7
16 - 20	1 122	2,5
21 - 25	3 366	0,8
26 - 30	578	0,4
31 - 35	254	0,2
36 and above	579	0,4
Total	6 135 117	100,0

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TABLE 34 **National Cattle Herd ('000 head)**

	Commercial Farming Areas (1)				
Year	Beef Herd	Dairy Herd	Total Herd	Communal Herd (2)	National Herd
1979	2 600	109	2 709	2 860	5 569
1980	2 304	106	2 410	2 869	5 279
1981	2 287	104	2 391	2 895	5 286
1982	2 352	102	2 454	3 240	5 694
1983	2 253	105	2 358	3 105	5 463

Notes: (1) As at 31st March

(2) As at year end

Source: C.S.O. and Department of Veterinary Services

TABLE 35.
Estimated Cattle Herd in the Small Scale and Communal Sectors(1) ('000 head)

Region	1979	1980	1981	1982	1983 (2)
Mashonaland	453	495	506	603	644
Matabeleland	612	612	663	664	628
Manicaland	339	339	260	398	417
Midlands	492	554	612	666	628
Masvingo	526	526	641	679	661
Chinhoyi	132	129	145	148	164
Gwanda	152	194	164	172	140
Chipinge	75	75	64	99	102
Zimbabwe	2 781	2 924	3 055	3 429	3 384

Note: (1) As at 30th September

(2) Includes Resettlement Areas

Source: Department of Veterinary Services

TABLE 36 **National Pig Herd ('000 head)**

Year	Large Scale Sector (1)	Small Scale Sector and Communal Farming Areas (2)	Total
1979	86	54*	140
1980	89	43	132
1981	95	84*	179
1982	103	86 (3)	189
1983	104	79 (3)	183

Notes: (1) As at 31st March

(2) Calendar Year

(3) Includes Resettlement Areas

* Department of Veterinary Services (30th September)

Source: C.S.O.

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TABLE 37. USE OF FERTILIZER BY FARMERS BY CROP

Crop	*Tonnes fertilizer*	%
Maize	340 000	61
Wheat and barley	45 000	8
Virgina and burley tobacco	45 000	8
Cotton	35 000	6
Sugar cane	25 000	4
Coffee and tea	20 000	4
Potatoes and vegetables	15 000	3
Soyas	10 000	2
Others	25 000	4

SOURCE: IDC

TABLE 38 AMMONIA AND NITROGENOUS FERTILIZER CONSUMPTION (TONNES)

		1977	*1978*	*1979*	*1980*	*1981*
Ammonia (NH_3)	Local production	57 827	75 421	66 216	65 000	63 507
	Imported	20 732	12 848	10 268	2 054	31 926
	Total consumption	79 559	99 269	76 484	95 514	95 433
Imported:						
Sodium nitrate $(Na\ No_3)$		982	1 098	1 520	748	1 992
Ammonium sulphate $(NH_4)\ 2SO_4$		6 435	7 421	2 980	7 916	12 397
Urea $NH_2\ Co\ NH_2$		—	—	—	33 895	94 369

SOURCE: Ministry of Industry and Energy Development

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Table 39: Average Fertilizer Use by Commercial Farmers
(kg/ha)

Year	Large-Scale Commercial (LSC)	Small-Scale Commercial (SSC)
1972	535	61
1973	565	60
1974	571	65
1975	547	82

Table 40: Commercial Farm Yields for Major Food Crops
(kg/ha)

Crop	Average Yields over Period 1976-80	
	LSC	SSC
Maize	4,726	1,786
Sorghum	2,499	682
Wheat	4,396	571
Sunflowers	545	530
Groundnuts	2,335	551
Cotton	1,709	829

Source: Tattersfield, J.R. (1982). The Role of Research in Increasing Food Crop Potential in Zimbabwe. The Zimbabwe Science News , Vol. 16 (1): 6-10, 24.

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TABLE 41. **Maize: Supply and Disappearance ('000 tonnes)**

Marketing Years	1979/80	1980/81	1981/82	1982/83	1983/84
Production (est)	1 205	1 598	2 767	1 786	884
G.M.B. Intake	512	815	2 013	1 391	617
Imports	149	95	-	-	-
Local Sales	635	724	665	1 046	1 273
Exports	265	86	305	492	252
Closing Stocks	85	158	1 201	1 035	123

Note: Figures do not add due to stock losses

Source: G.M.B.

TABLE 42. **Wheat Supply and Disappearance ('000 tonnes)**

Marketing Year	1979/80	1980/81	1981/82	1982/83	1983/84
G.M.B. Intake	159	163	201	213	124
Imports	-	3	17	31	55
Local Sales	169	205	223	234	227
Exports	8	5	...	-	-
Ending Stock	176	130	124	128	77

... less than 500 tonnes

Source: G.M.B.

TABLE.43 **Groundnut Supplies and Disposals ('000 tonnes)**

Marketing Year	Purchases (Local)		Disposal			
			Local		Export	
	Shelled	Unshelled	Edible	Crushing	Edible	Crus
1979/80	2,1	9,7 (6,3)	1,7	4,2	1,4	-
1980/81	1,6	15,1 (9,8)	2,9	5,1	3,2	-
1981/82	0,6	19,2(12,48)	1,9	5,9	2,9	-
1982/83	0,2	15,6(10,1)	3,8	3,9	3,7	-
1983/84	0,1	9,2 (6,0)	2,2	1,3	1,7	-

Note: Bracketed figures represent kernel equivalent.

Source: G.M.B.

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TABLE 44 . **Product Sales** (tonnes)

Financial Year	Cotton Lint			Commercial Cotton seed			Planting
	Local	Export	Total	Stock-feeds	Expressers	Total	
1979/80	10 648	56 516	67 164	6 134	91 549	97 683	2 616
1980/81	16 260	54 635	70 895	7 480	99 612	107 092	3 512
1981/82	12 713	51 164	63 877	3 814	122 447	126 261	2 360
1982/83	12 051	52 431	64 482	13 393	91 570	104 963	4 127
1983/84	10 953	49 679	60 632	269	101 404	101 673	5 842

Source: C.M.B.

TABLE 45. Sorghum Supply and Disappearance ('000 tonnes)

Marketing Years	1979/80	1980/81	1981/82	1982/83	1983/84
Production (est)	47	77	106	117	52
G.M.B. Intake	20	18	30	19	5
Imports	-	-	-	-	9
Local Sales	17	19	18	26	18
Exports	-	-	-	3	-
Ending Stocks	6	4	16	8	4

Source: G.M.B.